

Appendix A

Socioscientific and Ecological Engagement Dimensions Survey II (SEEDSII, *Adapted*)

Instructions: This survey asks you to provide your thoughts about a bird called the *red knot* (shown in the images below) and their seasonal travel called “migration.” Complete all questions thoroughly and to the best of your ability. If a question confuses you, please ask an instructor for clarification.



The red knot in nature (left) and the red knot being held by a biologist (right).



The red knot's migration path (red arrows) across the Americas.

1. Think about the red knot's migration path in the image above. **Explain** all of the things that you think will affect the red knot's ability to make it **from the start to the end** of their migration. Please **provide examples and drawings** to support your answer.

Please continue to the next page.

Consider how scientists investigate the red knot, understand things in nature, and how people should manage the environment. Please show how much you agree with the following statements by circling the number associated with them. Also, PLEASE EXPLAIN your responses in the space provided.

1 = Strongly Disagree, 2 = Disagree, 3 = Not Sure, 4 = Agree, 5 = Strongly Agree

2. <i>Scientific Method</i>	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
a. Considering what scientists actually do when researching environmental issues, there really is no such thing as a step-by-step scientific method.	1	2	3	4	5
b. Scientists follow the same step-by-step scientific method when researching environmental issues.	1	2	3	4	5
c. Scientists must use the scientific method to make sure their results are true and accurate.	1	2	3	4	5
d. Controlled experiments are the only way scientists develop truthful knowledge when they research environmental issues.	1	2	3	4	5

With actual examples you are familiar with, **please explain** why you responded to the items above the way you did.

Please continue to the next page.

3. <i>Scientific Observation</i>	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
a. Scientists should never disagree because they observe the same events in nature in the same way.	1	2	3	4	5
b. Scientists can disagree because they can observe the same events in nature differently.	1	2	3	4	5
c. Scientists should never disagree because they should interpret the same events in nature the same way.	1	2	3	4	5
d. Disagreement is normal in science because scientists can interpret the same events in nature differently.	1	2	3	4	5

With actual examples you are familiar with, **please explain** why you responded to the items above the way you did.

Please continue to the next page.

4. <i>Science, Technology, and the Environment</i>	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
a. Scientific evidence should be the only consideration used when managing environmental problems.	1	2	3	4	5
b. Scientists should not have the only say about how environmental problems are solved.	1	2	3	4	5
c. Eventually, science and technology will solve all of our environmental problems.	1	2	3	4	5
d. People should only consider scientific data to effectively manage environmental problems.	1	2	3	4	5
e. Only scientists should determine how environmental problems are solved.	1	2	3	4	5
f. The belief that science and technology can solve all of our environmental problems is completely wrong.	1	2	3	4	5

With actual examples you are familiar with, **please explain** why you responded to the items above the way you did.

Please continue to the next page.

5. <i>Culture and Science</i>	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
a. Culture (for example: what a community values and believes) should influence how science is conducted when investigating environmental problems.	1	2	3	4	5
b. Culture (for example: what a community values and believes) should influence how science is used when solving environmental problems.	1	2	3	4	5
c. Culture (for example: what a community values and believes) should not influence how science is conducted when investigating environmental problems.	1	2	3	4	5
d. Culture (for example: what a community values and believes) should not influence how science is used when solving environmental problems.	1	2	3	4	5

With actual examples you are familiar with, **please explain** why you responded to the items above the way you did.

Please continue to the next page.

6. <i>Environmental Acts</i>	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
a. I am willing to give up things important to me (for example: using electronics or buying nice stuff) if it would help fix environmental problems.	1	2	3	4	5
b. I am willing to participate in an environmental/nature club.	1	2	3	4	5
c. I am willing to donate money toward an environmental cause.	1	2	3	4	5
d. I am willing to raise funds for environmental protection.	1	2	3	4	5
e. I am willing to persuade others that the environment is important.	1	2	3	4	5

With actual examples you are familiar with, **please explain** why you responded to the items above the way you did.

Please continue to the next page.

7. Perspectives About Nature	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
a. I genuinely feel sorry for nature (for example: wildlife, plants, and rivers) that suffers because of how environmental problems are managed.	1	2	3	4	5
b. I am unable to feel like it is my own experience when I see nature (for example: wildlife, plants, and rivers) suffer because of how environmental problems are managed.	1	2	3	4	5
c. I believe we have to take care of (for example: provide money for preserving and protecting) nature that suffers because of how environmental problems are managed.	1	2	3	4	5
d. I feel like I shouldn't have to care about nature (for example: wildlife, plants, and rivers) that suffers because of how environmental problems are managed.	1	2	3	4	5

With actual examples you are familiar with, **please explain** why you responded to the items above the way you did.

Please continue to the next page.

Post-assessment only: What would you say the best parts of this course are regarding what you experienced and learned? Please **provide examples** to support your answer.

We need to be able to know if you understood the questions above and were able to answer them completely. Your answers will remain anonymous, and nothing will happen to you based on how you answer.

Were there any questions you did not understand or that you were unable to answer completely?

Yes No

If yes, please explain which questions (number and letter; e.g., 4b) and what you did not understand or what prevented you from completing them.

Are you a male (M) or female (F)?

M F

What grade are you in?

6th 7th 8th 9th 10th 11th

What best describes where you live?

City/in town Country/rural on a farm Country/rural not on a farm

This is the end of the survey. PLEASE GO BACK AND MAKE SURE YOU RESPONDED TO EACH ITEM. Thank you very much for completing this. If you have any questions, please feel free to ask one of the survey administrators.

Appendix B

Encuesta de Dimensiones de Compromiso Sociocientífico y Ecológico II (SEEDSII, *Adaptado*)

Instrucciones: Esta encuesta te pide que compartas tus ideas sobre un ave llamada “playero ártico” (mostrada en las imágenes de abajo) y su viaje estacional llamado “migración”. Responde a todas las preguntas de manera completa y lo mejor que puedas. Si alguna pregunta te confunde, por favor, consulta con un instructor para aclararla.



Playero ártico en la naturaleza (izquierda) y siendo sostenido por un biólogo (derecha).



La ruta de migración del playero ártico (flechas rojas) a lo largo de las Américas.

1. Piensa en la ruta de migración del playero ártico en la imagen de arriba. **Explica** todo lo que crees que afectará la capacidad del playero ártico para viajar **desde el inicio hasta el final** de su migración. **Proporciona ejemplos y dibujos** para respaldar tu respuesta.

Por favor avance a la próxima página

Considera cómo los científicos investigan el playero ártico, entienden a la naturaleza y cómo las personas deberían manejar el medio ambiente. Por favor, indica cuán de acuerdo estás con las siguientes afirmaciones marcando con un círculo el número asociado. Además, **POR FAVOR, EXPLICA** tus respuestas en el espacio proporcionado.

1=Muy en desacuerdo, 2=En desacuerdo, 3=No estoy seguro/a, 4=De acuerdo, 5=Muy de acuerdo

2. Método Científico	Muy en desacuerdo	En desacuerdo	No estoy seguro/a	De acuerdo	Muy de acuerdo
a. Considerando lo que los científicos realmente hacen al investigar temas ambientales, en realidad no existe tal cosa como un método científico paso a paso.	1	2	3	4	5
b. Los científicos siguen el mismo método científico paso a paso al investigar problemas ambientales.	1	2	3	4	5
c. Los científicos tienen que utilizar el método científico para asegurarse de que sus resultados sean verdaderos y precisos.	1	2	3	4	5
d. Los experimentos controlados son la única forma en que los científicos desarrollan conocimiento verídico cuando investigan temas ambientales.	1	2	3	4	5

Con ejemplos reales con los que estés familiarizado, **por favor explica** por qué respondiste de la manera que lo hiciste.

Por favor avance a la próxima página

3. <i>Observaciones Científicas</i>	Muy en desacuerdo	En desacuerdo	No estoy seguro/a	De acuerdo	Muy de acuerdo
a. Los científicos nunca deberían estar en desacuerdo porque ellos observan los mismos eventos en la naturaleza de la misma manera.	1	2	3	4	5
b. Los científicos pueden estar en desacuerdo porque ellos pueden observar los mismos eventos en la naturaleza de manera diferente.	1	2	3	4	5
c. Los científicos nunca deberían estar en desacuerdo porque ellos deberían interpretar los mismos eventos en la naturaleza de la misma manera.	1	2	3	4	5
d. Estar en desacuerdo es normal en la ciencia porque los científicos pueden interpretar los mismos eventos en la naturaleza de manera diferente.	1	2	3	4	5

Con ejemplos reales con los que estés familiarizado, **por favor explica** por qué respondiste de la manera que lo hiciste.

Por favor avance a la próxima página

4. <i>Ciencia, Tecnología, y el Medioambiente</i>	Muy en desacuerdo	En desacuerdo	No estoy seguro/a	De acuerdo	Muy de acuerdo
a. La evidencia científica debería ser lo único que se utilice al abordar problemas ambientales.	1	2	3	4	5
b. Los científicos no deberían tener la única voz en la forma en que se resuelven los problemas ambientales.	1	2	3	4	5
c. A la larga, la ciencia y la tecnología resolverán todos nuestros problemas ambientales.	1	2	3	4	5
d. Las personas deberían considerar solamente datos científicos para abordar de manera efectiva los problemas ambientales.	1	2	3	4	5
e. Solo los científicos deberían determinar cómo se resuelven los problemas ambientales.	1	2	3	4	5
f. La creencia de que la ciencia y la tecnología pueden resolver todos nuestros problemas ambientales es completamente errónea.	1	2	3	4	5

Con ejemplos reales con los que estés familiarizado, **por favor explica** por qué respondiste de la manera que lo hiciste.

Por favor avance a la próxima página

5. <i>Cultura y Ciencia</i>	Muy en desacuerdo	En desacuerdo	No estoy seguro/a	De acuerdo	Muy de acuerdo
a. La cultura (por ejemplo: lo que una comunidad valora y cree) debería influir en cómo se realiza la ciencia al investigar problemas ambientales.	1	2	3	4	5
b. La cultura (por ejemplo: lo que una comunidad valora y cree) debería influir en cómo se utiliza la ciencia al resolver problemas ambientales.	1	2	3	4	5
c. La cultura (por ejemplo: lo que una comunidad valora y cree) no debería influir en cómo se realiza la ciencia al investigar problemas ambientales.	1	2	3	4	5
d. La cultura (por ejemplo: lo que una comunidad valora y cree) no debería influir en cómo se utiliza la ciencia al resolver problemas ambientales.	1	2	3	4	5

Con ejemplos reales con los que estés familiarizado, **por favor explica** por qué respondiste de la manera que lo hiciste.

Por favor avance a la próxima página

6. Actos Ambientales	Muy en desacuerdo	En desacuerdo	No estoy seguro/a	De acuerdo	Muy de acuerdo
a. Estoy dispuesto/a a renunciar a cosas importantes para mí (por ejemplo: usar electrónicos o comprar cosas bonitas) si esto ayudara a solucionar problemas ambientales.	1	2	3	4	5
b. Estoy dispuesto/a a participar en un club/grupo enfocado en temas ambientales o de la naturaleza.	1	2	3	4	5
c. Estoy dispuesto/a a donar dinero para una causa ambiental.	1	2	3	4	5
d. Estoy dispuesto/a a recaudar fondos para la protección del medio ambiente.	1	2	3	4	5
e. Estoy dispuesto/a a persuadir (o tratar de convencer) a otros de que el medio ambiente es importante.	1	2	3	4	5

Con ejemplos reales con los que estés familiarizado, **por favor explica** por qué respondiste de la manera que lo hiciste.

Por favor avance a la próxima página

7. Perspectivas acerca de la Naturaleza	Muy en desacuerdo	En desacuerdo	No estoy seguro/a	De acuerdo	Muy de acuerdo
a. Genuinamente siento lástima por la naturaleza (por ejemplo: vida silvestre, plantas y ríos) que sufre debido a cómo se manejan los problemas ambientales.	1	2	3	4	5
b. Soy incapaz de sentir como mi propia experiencia el ver que la naturaleza (por ejemplo: vida silvestre, plantas y ríos) sufre debido a cómo se manejan los problemas ambientales.	1	2	3	4	5
c. Creo que debemos cuidar (por ejemplo: proporcionar fondos para preservar y proteger) a la naturaleza que sufre debido a cómo se manejan los problemas ambientales.	1	2	3	4	5
d. Siento que no debería importarme la naturaleza (por ejemplo: vida silvestre, plantas y ríos) que sufre debido a cómo se manejan los problemas ambientales.	1	2	3	4	5

Con ejemplos reales con los que estés familiarizado, **por favor explica** por qué respondiste de la manera que lo hiciste.

Por favor avance a la próxima página

Solo para la posevaluación: ¿Cuáles dirías que fueron las mejores partes de este curso en relación a lo que aprendiste y tu experiencia de haber participado? Por favor, **proporciona ejemplos** para respaldar tu respuesta.

Necesitamos saber si comprendiste las preguntas anteriores y pudiste responderlas completamente. Tus respuestas permanecerán anónimas y no te pasará nada basado en cómo respondas.

¿Hubo alguna pregunta que no entendiste o a la que no pudiste responder completamente?

Sí No

Si respondiste que sí, por favor explica cuáles preguntas (número y letra; por ejemplo, 4b) no entendiste o qué te impidió responder completamente.

¿Eres hombre (H) o mujer (M)?

H M

¿En qué curso estás?

6to 7mo 8vo 1ero 2do 3ero

Este es el final de la encuesta. POR FAVOR, REGRESA Y ASEGÚRATE DE HABER RESPONDIDO A CADA ASUNTO. Muchas gracias por completar esto. Si tienes alguna pregunta, no dudes en preguntar a alguno de los profesores o guías.

Appendix C

Combined rubric of students' qualitative responses with students' quotes (translated from Spanish) as exemplars

Comprehensiveness of factors that affect red knot migration	Score	0 - Unaware	1 - Unidimensional general	2 - Unidimensional detailed	3 - Bi-dimensional general	4 - Bi-dimensional detailed
	<i>Anchor points</i>	No comprehensible natural or human factors mentioned that affect the red knot.	Indicates only environmental OR human factors affecting migration with no/implicit explanation of the impact.	Indicates environmental OR human factor(s) affecting migration with detailed explanation of the impact.	Includes both environmental AND human factors affecting migration with no/implicit explanation of the impact.	Explicitly states both environmental AND human factors affecting migration with detailed explanation of the impact.
	<i>Exemplars</i>	I don't know	The red knot is not bigger than a hand, and thus, considering how long is its migration route, the winds and predators in its path could affect its survival	Well, let's begin with the urbanization and pollution. Example: on a beach where the red knot goes to rest, a real estate built a building and that construction site allowed the beach to be polluted, then, the red knot cannot eat because everything's dirty. Also, that dogs are free roaming on beaches is very detrimental since they can eat or startle the red knots	It could be left without resources, rest in an unsuitable zone (with dogs, pollution) [student left a drawing saying "red knot killed by a dog"]	The things that might affect it from start to finish I think could be the variety of climates or the lack of food. Also, the spaces they got used to staying at may be occupied, having to find another space, and/or facing pollution in some places and the dirty beaches. [student drew a flying bird with a question mark over it, looking at a coast with many buildings on it]

NOS Constructs	Score	0 - Nonsensical/ uninformed	1 - Stereotypical	2 - Transitional	3 - Implicitly transcending	4 - Explicitly transcending
Methodology of environmental science investigations	<i>Anchor points</i>	Nonsensical and/or irrelevant representation or writing "I don't know."	Bounded by explicitly stated stereotypical views such as that scientists only work in a lab and/or use only stepwise experimental methods.	A mix of explicitly stated stereotypical and non-stereotypical views (e.g., situating scientific research in the field and step-by-step methods are required). Tentative whether scientists use multiple methods/there are no set scientific methods.	Indicates non-stereotypical/accurate views about place and methods (e.g., scientists are clearly researching in the field and/or states scientists do not use a set scientific method) with implicit or no justification and/or example.	Explicitly transcends stereotypical views in that the response accurately conveys many methods beyond step-by-step controlled experiments are appropriate, and provides clear justification and/or example.
	<i>Exemplars</i>	I don't know about the topic	Scientists have to do everything step by step	Perhaps there are more methods besides the scientific method and each person is free to do as they want because maybe they give the same results	The scientific method can change according to the person who investigates and/or what is being investigated	Scientists don't always follow the same scientific methods since there are many of these, and if the same one were to be used in all investigations, the results wouldn't vary that much.
Scientific observation/ interpretation of nature	<i>Anchor points</i>	Nonsensical and/or irrelevant representation or writing "I don't know."	Explicitly indicates that scientists' simultaneous observations and/or claims (i.e., thoughts and interpretations) must agree.	Tentative whether disagreement may happen (e.g., vacillates between disagreement and agreement) with no justification.	Indicates disagreement is normal (no representation of process) with implicit/tacit justification (e.g., that disagreement derives from and/or is a function of thought generation or learning processes).	Explicitly states disagreement is a normal process of ongoing scientific inquiry with explicit/overt justification (e.g., disagreement is a process that moves scientific thinking forward and/or toward the truth).

	<i>Exemplars</i>	Always and with my mind's help	Scientists have to try to agree in order to not have disputes	Referring to Likert items: A) It might or might not be [that scientists never disagree because they observe same events the same way]; B) Each person has a different point of view of things; C) I don't think it works that way, but I'm not sure [that scientists never disagree because they observe same events the same way]; D) Makes sense [disagreement is normal in science because scientists can interpret the same events in nature differently].	All scientists use and have different points of view	Due to each person having distinct points of view, there would be both agreements and disagreements, but this is how a better way of solving certain problems is reached
<i>Role of science and technology in solving environmental issues</i>	<i>Anchor points</i>	Nonsensical and/or irrelevant representation or writing "I don't know."	Resembles scientism by explicitly indicating that science and scientific evidence are the only sources of contentious environmental issue resolution.	Tacit and generic indication that other factors beyond science <i>might</i> be considered for SSI resolution (e.g., generically indicating science is not always correct, or that other people or the public can have ideas or feelings).	Recognizes other factors and/or stakeholders beyond science/technology for SSI resolution. However, factors and stakeholders are implicitly and/or tacitly described.	Explicitly states and specifies factors and/or stakeholders beyond science/ technology for SSI resolution. Factors are typically distal and abstract (e.g., economic, historical, geographic, property rights, multidisciplinary, and beyond science).

	<i>Exemplars</i>	I can't see much but a little bit.	Scientists are the only source of information that is reliable	Science and technology will not be able, irrespective of how advanced they are, to fix all of our environmental problems	Not only scientific evidence; Other specialists/experts might also be able to help	To solve environmental problems, it's important as was said in the activities, to take different opinions, for example cultural, personal, political, scientific, etc. And I'm not very sure that all can be solved, but something can be achieved
<i>Cultural influences on environmental science and its use</i>	<i>Anchor points</i>	Nonsensical and/or irrelevant representation or writing "I don't know."	Explicitly indicates that cultural considerations should not influence science.	Indicates that cultural considerations should influence science but only in limited cases or to a minor extent, and/or is tentative whether culture should influence science.	Explicitly recognizes that cultural considerations should influence science but with implicit/tacit justification.	Explicitly states that cultural considerations should influence science and explicitly provides examples and/or reasoning as justification.
	<i>Exemplars</i>	I didn't understand	I think a culture shouldn't intrude on how a scientific investigation is carried out and how science is used to solve environmental problems. Not sure, maybe cultures feel invalidated by small things and sometimes scientists are very invasive	People's culture are beliefs that should be respected, but I don't think they should influence science that much	A person's thoughts or data, or a group of people could help science	Culture and the community influence when making decisions in science, because some may be in agreement and others not

Pro-environmental intent	Score	0 = Unwilling/low	1 = Moderately willing (no specific action)	2 = Moderately willing (with specified action)	3 = Highly willing (no specific action)	4 = Highly willing (with specified action)
	<i>Anchor points</i>	Pro-environmental intent is largely absent.	Willingness to commit to actions that collectively require little to moderate personal investment.		Willingness to commit to actions that collectively require significant personal investment.	
	<i>Exemplars</i>	I'm not sure that I am willing to [give up] things that are important to me, but I could do it if it's very necessary	Really, I very much agree with taking care of the environment but there are certain things I wouldn't do	I am not sure that I am willing to completely renounce electronics and other things, but I am willing to donate, participate, and support environmental topics	Environmental problems are important facts that we are living through, and they not only affect some but everyone. And in the long run, the problems keep growing which, to me, makes it important to deal with them	To me, I find it very important to take care of and conservation of species, besides, some live very close to us and in the end, what affects them might very well be harmful to humans.
Compassion for nature impacted by contentious environmental issues	Score	0 = Apathetic	1 = General caring (no reference)	2 = General caring (with reference)	3 = Deep compassion (no reference)	4 = Deep compassion (with reference)
	<i>Anchor points</i>	Caring for nature impacted by contentious environmental issues absent.	Generic and sometimes perfunctory care for nature impacted by contentious environmental issues. Often exhibit diffusion of responsibility (e.g., "we statements").		Deep levels of genuine care for nature impacted by contentious environmental issues. Often exhibit personal feelings of responsibility (e.g., "I statements").	
	<i>Exemplars</i>	Because I know that even if I contributed, nothing would change	I care about nature and I believe we should take care of/protect it from environmental problems	<i>None provided</i>	As I said, to me, nature, and taking care of it, are very important, so according to me, we should do these things.	Personally, I care a lot about the care we have for nature, because in the end, in large part we humans are the main ones who interfere in the natural cycles, and we end up with species that were, are, or could be regulators of nature.