Nature of Science Card Exchange English Only

CISIP

Communication in Science Inquiry Project

PHASE I

1. The game begins with the facilitator giving each participant a randomly drawn set of 8 cards.
2. The participants evaluate their cards according to what they can most and least affirm. They then have a period of time in which to mill about examining each other's statements and making trades. Sufficient time should be allowed for each participant to examine every other participant's cards.
3. The goal is to improve one's hand by trading cards one for one, in other words the participants' goal is to trade cards they like less for ones they like more. There is no discarding.
4. Allow 5-8 minutes for this phase of the game.
5. At the end of phase one have everyone sit down while giving them the next set of instructions. Instructions for each phase should not be given in advance.

PHASE II

1. The participants are again to mill about, but this time seeking someone with whom they can pair.
2. The pairing rules are that each pair must hold 6-8 cards on which they have relative agreement.
3. Each member of a pair must contribute at least 3 cards. This is important if the pairs are to be truly formed by compromise.
4. The pair's remaining 4-5 cards are discarded.
6. Allow 7-10 minutes for this phase of the game.

PHASE III

1. Phase three of the game is a repeat of phase two, except now the pairs form quadruplets.
2. Each foursome is to hold 6-8 cards with each pair contributing at least 3 cards.
3. Once the foursome has been established, the participants are asked to rank order their cards. Then if they wish they may discard the 2 bottom-ranked cards.
4. Based on this final set of cards the participants cooperate to **write a statement** of paragraph length on the **nature of science**.
5. At the conclusion of the game ask the various groups to share their paragraphs and to say why they accepted some statements while rejecting others. Generally this is enough to precipitate vigorous **discussion.**
6. Facilitate the discussion by writing on the board a few phrases that characterize the views being presented.
7. Allow 20-30 minutes for this phase of the game.

FOLLOW UP DISCUSSION

1. Follow up the discussion with a presentation or handouts of two cases studies from the history of science. Look for examples of the statements on the nature of science that the participants have advocated in their card exchange summaries.
2. The case studies can be presented orally in a recitation format by the facilitator or in the form of a printed handout. The advantage of using a handout is that the groups working individually at comparing and contrasting their card exchange summaries with case studies do a more thorough job. The disadvantage is the amount of time required.
3. The discussion of the card exchange summaries vis-a-vis the case studies concludes the set induction. From this point begin the main body of instruction on the nature of science.
4. Facilitator sets time allowed

1

Science is open-ended, but scientists operate with expectations based on the predictions of theories.

2

A theory is what scientists strive for: a large body of continually refined observations, inferences, and testable hypotheses.

3

Scientists cannot function in isolation. Theories are developed over time and require multiple sets of data based on a variety of methodologies.

4

In general, scientists plan investigations by working along the lines suggested by theories, which in turn are based on previous knowledge. Theories serve to give direction to observations, i.e., they tell one where to look.

5

A theory is a logical construct of facts and hypotheses that attempts to explain a range of natural phenomena and that can be tested in the natural world.

6

If a scientist develops a theory but shares it with no one, she has still contributed to the work of science.

7

A scientist should not allow preconceived theoretical ideas to influence observation and experimentation.

8

Unless an idea is testable it is of little or no use; thus, scientists attempt to convert possible explanations into testable predictions.

9

Recording ideas and observations is critical to the work of scientists.

10

Science is never dogmatic; it is pragmatic--always subject to adjustment in light of solid, new observations.

11

A phrase such as “Many scientists believe...” misrepresents scientific inquiry because scientists deal in evidence.

12

Scientists construct knowledge by crafting arguments from evidence.

13

Money spent on science projects such as NASA space flights would be better spent on healthcare for the needy.

14

Science knowledge is always objective and self-correcting.

15

Credit for our advanced way of life must go to science and scientific progress.

16

Funding influences the direction of science by virtue of the decisions that are made on which research to support.

17

Scientific discourse is influenced by the culture, ethnicity, and gender of the participants, which can lead to bias in science.

18

The predominance of men in the sciences has led to bias in the choice and definition of the problems scientists have addressed. This male bias is also one factor in the under representation of women in science.

19

Scientific facts are manufactured through social negotiations. Nature has nothing to say on its own behalf.

20

Dialogue among scientists is essential for "doing" science.

21

Until recently, some racial minorities, because of restrictions on their education and employment opportunities, were essentially left out of the formal work of the science establishment. The remarkable few who overcame these obstacles were even then likely to have their work disregarded by the science establishment because of their race.

22

Scientific language can be alienating to those who are not a part of the scientific discourse community.

23

Science leads to generalizations based on observations or theories. Science always aims to be testable, objective and consistent.

24

The norms and values of science shape the nature of scientific discourse.

25

The forms of scientific discourse influence how science is conducted.

26

Scientific progress has made possible some of the best things in life and some of the worst.

27

Scientists use discourse as an inquiry tool. They talk about research design, what their data means etc. in their research groups and with colleagues working on the same questions.

28

Scientists frame the argument and chains of evidence they will present and write in public forums to persuade others that their procedures and interpretations of the data are correct.

29

Scientists present their research findings and debate in public forums, professional meetings, and publications (print and on-line).

30

Science is often a solitary endeavor.

31

Writing and talking is the way science knowledge is constructed by allowing others to replicate and or challenge findings.

32

Discussion is an important step in the creation of scientific understanding.

33

Reflection, oral discourse and writing while doing science lead to under-standing essential to the scientific enterprise.

34

Understanding a scientific argument is essential to understanding science.

35

Scientific language use identifies who is and who is not a part of the scientific community.

36

Scientists use language to engage with and construct science understandings.

37

Understanding and using scientific language allows a person to participate in the scientific community.

38

Writing is the primary vehicle by which scientists communicate with one another around the world.

39

Scientists use written and oral language to communicate information to the public so the public can:

- Make informed decisions
- Determine the validity of claims, and
- Take informed action

40

Scientists cooperate in investigations. Successful teamwork is essential to many scientific enterprises.