

The Environmental Relationships Test ©2010 Robert L. Arnold

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Please complete this test before reading the rest of the essay.

Directions: Imagine that you have taken a huge knife and cut out a block of earth several-miles square that includes your home. Lift the block to eye level. Selecting one or more items from each category listed below, draw a three-dimensional picture (model) of what you would see from the side and top of the block of earth. Illustrate the essence of your concept of each item selected and label each item you select. Leave blank any of the ten variables about which you know nothing or very little.

1. Bedrock: Sandstone, quartzite, limestone, marble, granite, shale, slate, gneiss, conglomerate or any other rocks you might know about. (Note – you may add items consistent with each category.)

2. Minerals: Copper, zinc, talc, oil, iron, coal, gold, silver, plutonium, garnet etc.

3. Relief features: Mountain, hill, valley, plateau, plain, undulating-terrain etc.

4. Soil types: Sand, clay, loam, humus, gravel, sandy loam, clay loam etc.

5. Water and Drainage: River, brook, creek, pond, lake, ocean, gulf, sea, poorly drained, excessively drained, water cycle etc.

6. Vegetation: Moss, lichen, shrubs, maple, birch, hemlock, pine, palm, grass, tamarack, cedar, broadleaf evergreen, redwood, poplar etc.

7.Animal: Spider, flea, mosquito, tarantula, deer, bear, fox, rabbit, antelope, lion, elephant, crocodile, raccoon, ground hog, trout, bass, pike etc.

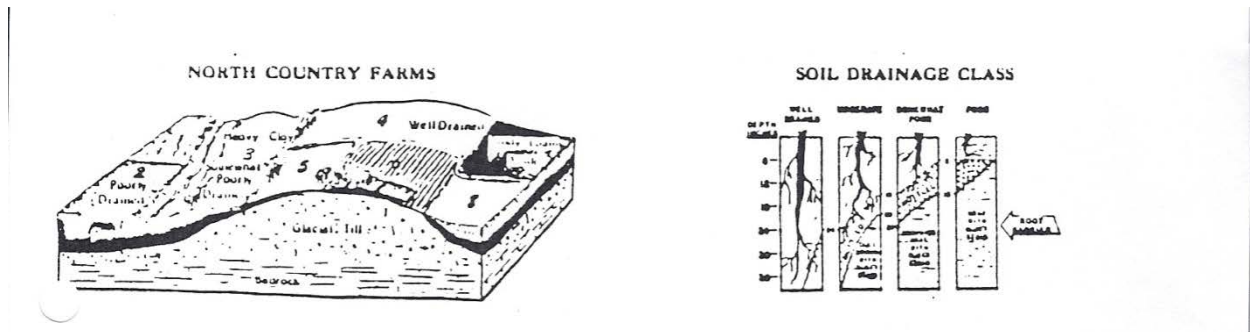
8.Weather/climate: Temperature, humidity, thunder, lightning, wind, rain, tornado, hurricane, pressure, jet stream, temperate, torrid, arctic, tropical etc.

9.Location: North, south, east, west, longitude, latitude etc.

10. Manmade objects and alterations: Buildings, machines, landscape alterations, roads, bridges, airports, electric light poles, cable networks, etc.

“The Environmental Relationships Test” has been in use in classrooms for over four decades. The test is deceptively simple. It contains a listing of common terms, recognized by most people who speak English and have attended school. These terms are grouped within categories. The ten categories covered here are the major variables that are found in every environment on earth and perhaps elsewhere, from the rocks and minerals under the surface, to the atmosphere above and beyond. The examinee is asked to select one or more terms from each category, and recalling the concepts acquired from experience including school instruction, draw or construct a three-dimensional model that looks like the place being represented. The representations must accurately reflect the essence of concepts held by each examinee. Each illustration is labeled appropriately and the examinee is required to include only those concepts he or she can personally verify.

The three-dimensional, cross-section of a segment of the earth's environment, often used by geographers and geologists to communicate their ideas, is an example of an iconic model at the synthesis level of cognition which the examinee is asked to construct. The following illustration shows such a model with enhanced labels and an exploded diagram for additional emphasis:



The amount of detail contained in the model is governed by the intended message of its author. The richness and accuracy of the concepts are variable factors in the communication, along with the level of developmental maturation. For those who have reached the levels of concrete or formal operations, who cannot represent accurate concepts within the model, may not have adequate skills for drawing, or incomplete or unavailable concepts or both. A person at the pre-operational or motor sensory levels would not be expected to deal logically with the construction of the model.

Interpreting the results of the examinee's constructions requires judgments that are based on the following criteria:

- A. The presence of all variables in a model.
- B. Concepts of each variable, as illustrated in the model, reflecting accurate or at the very least plausible discriminations.

- c. The elements of the model must show internal consistency, what is shown in one variable cannot be contradicted by another.
- d. Plausible combinations between all variables are extensive, if not infinite. There is no answer sheet that covers all the correct or plausible combinations. Each model must be judged independently; correctness requires a logical explanation of the concepts of each variable and the relationships between variables.
- e. An examinee might produce an accurate and complete model from memory. To ensure that this possibility does not happen, simply change a variable and ask the examinee to re-construct the model as a result of this change. If conceptualization of the relationships has occurred, not just simple memorization, the examinee will be able to construct many plausible combinations.
- f. The content of the model is judged by clarity and organization, comprehensiveness, accuracy or plausibility, internal consistency, support from personal experience and the experiences of others, and awareness of the unanswered questions.
- g. The expectations for performance are conditioned by knowledge of the developmental levels of learners, regardless of age or grade level designation.

Three interrelated developmental models by Jean Piaget, Viktor Lowenfeld and Jerome Bruner are especially important when

interpreting the constructions of each learner. A lack of logical relationships in a drawing may not indicate a deficiency in concept attainment for lack of learning opportunities; it may be an appropriate developmental response related to the level of maturation achieved by the learner. For instance, there are four levels in Piaget's model of intellectual development – motor-sensory, pre-operations, concrete operations and formal operations. A pre-operational (pre-logical) learner cannot be expected to construct and defend logical connections between concepts. Making these connections requires logic which emerges at the level of concrete operations and is expanded at the level of formal operations. These stages come with biological maturation, not simply by exposure to experience, no matter how efficient the instruction is considered to be.

The concrete operations learner can make logical connections between concepts, but only if they are related to direct, concrete experience. The formal operational learner is able to manipulate abstract ideas about places and events remote in time and space.

According to Lowenfeld, visual expressions emerge first as random scribbling, followed by controlled scribbling, then pre-schematic drawing, schematic drawing, dawning realism, pseudo realism, realism and finally abstraction. Abstract representation builds upon the prior stages and often contains a combination of representations from the prior stages.

A pre-schematic drawing is typically randomly-placed forms that resemble objects and events as seen through the eyes of the beholder. A schematic drawing shows the emerging stage of logical

connections, where the learner establishes a baseline or anchor at the bottom of the page, and draws everything in two dimensions from the baseline. Dawning realism reveals the first signs of the third dimension. At this level, objects are placed above the baseline, on a base-plane, and there is an attempt to show depth, albeit with difficulty. The realistic picture shows overlapping, a definite base-plane, and recognizable dimensionality. A realistic drawing contains detail, proportionality, depth and fine discriminations.

A pre-schematic learner cannot be expected to locate recognizable objects in the environment in logical relationships. The schematic learner at an early concrete operational level can be expected to show the beginnings of conceptual connections, while the stages of realism finds the learner capable of completing a model which satisfies all the criteria of the Environmental Relationships Test.

Bruner described the stages of language development as enactive, iconic and symbolic. Enactive language is a non-verbal, basic response to experiential stimuli, leading to the development of iconic or conceptual after-images of the experience. These after-images are the foundations for symbolic language – symbols being the vehicles for meaning.

Unfortunately, written language appears the same on the printed page, whether it is used symbolically, that is, full of meaning, or as signs with very focused and restricted meanings, or simply as words with no real meaning at all.

Many traditional assessment techniques depend almost wholly upon the written form of symbols. This practice has led to

acceptance of responses that do not discriminate between various uses of words. In contrast, “The Environmental Relationships Test” requires the visual expression of concepts in iconic form that closely resemble the ways the subject appears to the learner. When the iconic representations are supplemented with appropriate symbols, it can be assumed that the learner is using the language, symbolically. That expressed in an iconic form represents personal experience with the objects or events; that which can be expressed symbolically represents an iconic level of understanding. By requiring an iconic representation of environmental concepts and relationships combined with written language, the connection between concepts and language is established.

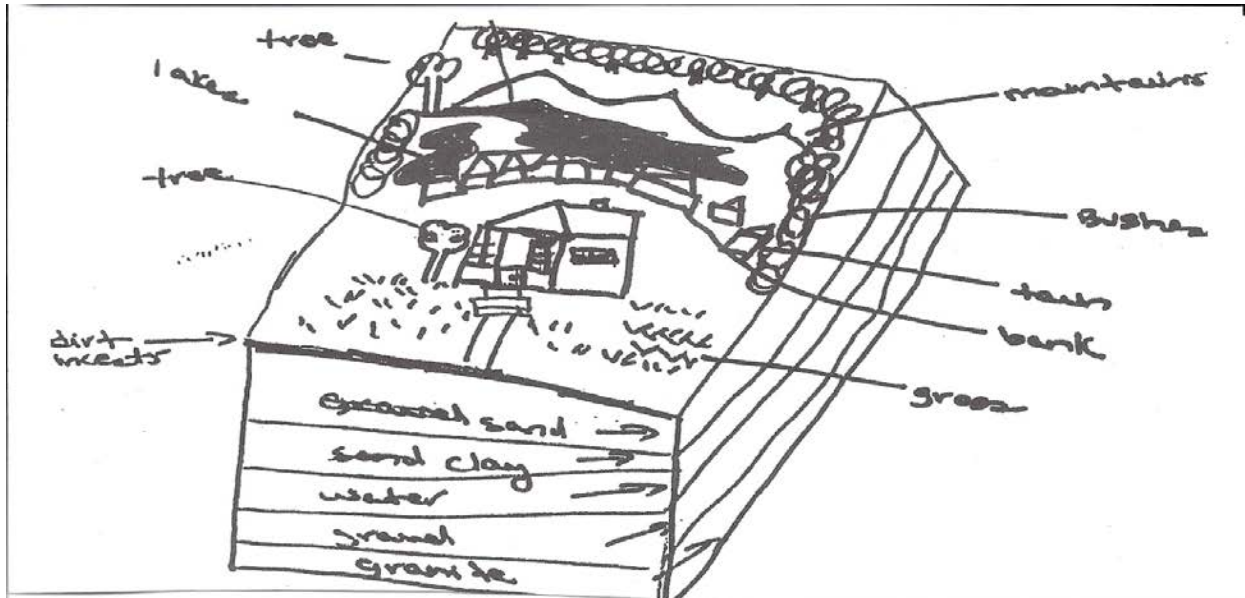
“The Environmental Relationships Test” generates assessment data used to judge levels of achieved cognition. Its focus is not only on the natural/physical realities but also the social/cultural, economic and political realities for any location in the world. The first level is knowledge of terminology. (Bloom et.al.) This is the level most instruction in our schools is aimed to achieve. The second level is referred to as comprehension which is sub-divided into translation, interpretation and extrapolation. Examinees are competent at the comprehension level when terminology can be stated in their own language, can be defined and can be recognized as having some personal connection beyond the formal definitions. A level of application is reached when the defined terms are linked directly to personal experiences.

Concepts held by the examinee are an outgrowth of applications that have personal references. When concepts have few dimensions of meaning due to developmental or experiential immaturity, they are

more illustrative of the application stage. If a concept has many dimensions of meaning, it has most likely evolved beyond the level of analysis. Analysis involves taking apart the ideas contained in a concept and isolating or discriminating each dimension. These multiple discriminations are essential to full concept attainment required of a synthesis within and between concepts. Synthesis is putting together combinations that form a new whole. This is a unique construction that relates to the unique personalities, skills, and creativity exhibited by the individual learner. (Standardized tests cannot measure these unique constructions since they are not “standardized.”)

Synthesis occurs when a three-dimensional model is constructed, where many variables of the environment are interrelated. The extent of the synthesis is determined by the number of variables that can be interrelated within the model. A complete synthesis contains all the environmental variables, represented accurately and verified. Once this level is reached, the ability to evaluate critically is the result. Critical evaluation grows out of syntheses and involves logical judgments about the system, applying internal and external criteria. Effective problem solving is the result.

Here are two typical examples of the results of the “Environmental Relationships Test” administered to college seniors, majors in elementary teacher education, both of whom have passed the New York State Regents exam for Earth Science and are about to graduate as certified teachers. Study this first model carefully in preparation for understanding an analysis of the levels of competency exhibited regarding an environmental system and the ability to visually represent one’s concepts accurately.



Notice that this learner's identification of parts of this system is stated in gross terminology. Example: tree rather than the name of a specific tree, bushes rather than the name of a particular shrub. When asked if a particular shrub or tree was in mind, the learner had difficulty coming up with the name of any shrub or tree that could be found in this particular environment.

The listing of sub-surface strata reveals an awareness of what conceivably could be found there but the concept of actual relationships is missing. Conceptually, the model reveals a very limited amount of understanding, even though these objects are experienced frequently and were studied in their formal schooling.

As for the ability to represent ideas graphically, this learner exhibits skills that emerge typically between seven to ten years of age. The drawing is in two dimensions, except for the overall representation of three dimensions provided in the instructions. Take note of the house. The front portion of the house is roughly in three dimensions but it lies flat in two dimensions. The back portion is clearly in two dimensions.

This stage of development in the ability to express one's concepts was called "dawning realism" by Viktor Lowenfeld who studied these matters in depth.

Results from administering this test to this 21 year old (and hundreds of others) reveals nearly a total lack of conceptualization of the parts and the interrelatedness of all the variables in a given area of the real world, one's home town or areas of the country or the world. It also reveals a predominate lack of skill in illustrating three-dimensionality. Since this adult test-taker shows skills that ordinarily appear with 7 to 10 year olds, apparently our educational system has allowed its charges to remain arrested in growth patterns that first appeared at these early age levels.

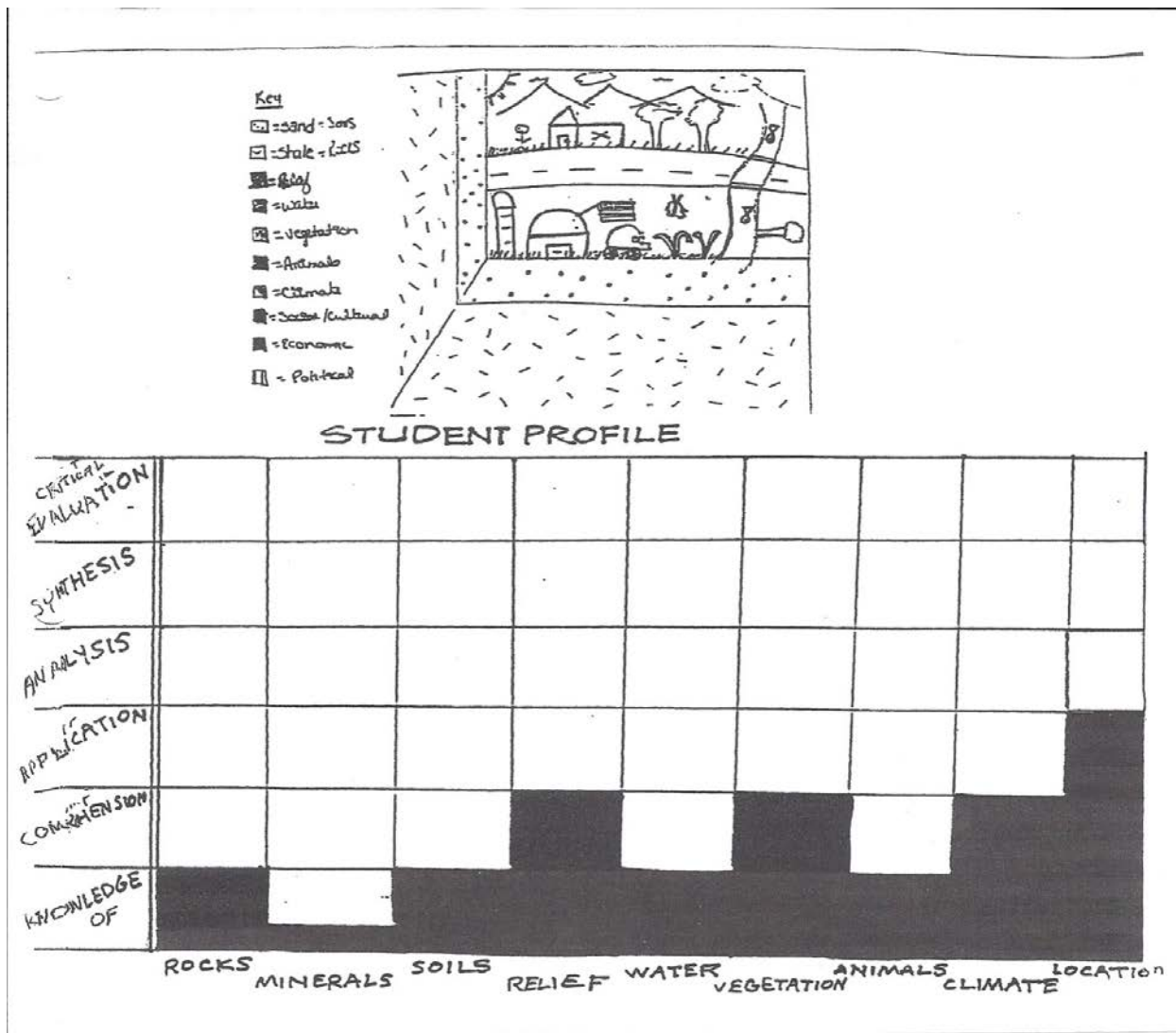
For this individual to conceptualize the results of experiences indicated in each of the listed categories, wherever possible, those experiences should have been direct and individually purposeful or at least direct experience that was carefully contrived to aid in gaining important exposure to the variables of any region. These requirements have obviously not been met.

The second example has been evaluated using "Bloom's Taxonomy, Cognitive Domain." This taxonomy is organized from the least complex cognition to the most complex. The least complex cognition is simple recall of information, referred to as "knowledge of something. The next more complex level is "comprehension." Comprehension involves translation, interpretation and extrapolation. The next level is "application" wherein the learner sees a connection between that which is recalled and simply understood concerning personal experiences. The next level is "analysis" that involves taking apart the prior understandings. Analysis is followed by "synthesis" whereby the learner is able to put together the parts into a new set of relationships that represents one's personal experiences.

Synthesis is a creative process that results in unique

representations that cannot be measured by standardized tests. The highest level of cognition results from the achievement of synthesis. It is called “critical evaluation.” Critical evaluation is necessary for intelligent decision-making and problem solving abilities.

Test results for this next learner, rated according to Bloom’s Taxonomy of Educational Objectives from simple to complex cognition, namely knowledge of something, limited comprehension, application, analysis, synthesis and critical evaluation illustrates graphically how this learner did not perform much above the level of recalled information or “knowledge of” and simple comprehension.



While completing the test, these learners, exhibiting these deficiencies, revealed a sinking realization of their ignorance about matters once covered in their texts but long since forgotten and now impossible to retrieve.

Why is this so important? Firstly, this involves just the world in which we live. It is the world from which we get our food, breathe our air, obtain our resources and manufacture our goods. Ignorance about this world allows us to ignore global warming, pollute the environment, profit from its destruction and view human societies through stereotypical lenses.

In addition, a working model of the interrelatedness of the variables of our world, essential to recognizing and judging the validity of actions taken by humans, is missing. It should be obvious to everyone that general education in our schools has failed to produce this intellectual orientation. Yet, there seems to be a reluctance to admit to this reality.

We are left with an educational enterprise that has created effective specializations for some that reflects high levels of individual motivation to achieve, (mainly to make money or seek approval) without the awareness of or concern for the relationships of one set of ideas on another or one set of actions on another.

We must re-organize our schools to develop the basic general education that is mandated if we are to resolve our national and global problems.

Suggested reading:

Arnold, Robert L. (2013) *Remaking our Schools for the Twenty-First Century – A Blueprint for Change/Improvement in our Educational Systems*. Ithaca Press.

Bruner, Jerome. (1960) *The Process of Education*, Boston. Harvard University Press

Bloom, B et.al. (1956) Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook I: Cognitive Domain

Flavell, John (1963) The developmental psychology of Jean Piaget. New York. Van Nostrand.

Lowenfeld, Viktor (1947) CREATIVE AND MENTAL GROWTH, New York. Macmillan Co.