Implementing Different Learning Styles Using Reusable Learning Objects

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Abstract:

The issue of learning styles is becoming increasingly important in the last two decades. It has been discovered that students usually achieve better if their learning styles are matched with their instructors' teaching styles. It is, however, quite difficult, if not impossible, for an instructor to adapt his/her teaching style in a lecture to accommodate all of the various learning styles of students in a classroom. One potential solution is the use of Reusable Learning Objects (RLOs). With RLOs, the same course materials can be packaged and delivered according to different learning styles. The concept was implemented and tested in course ARTE310 at Northern State University. The data collected shows improvements in the performance of students, and their subjective satisfaction level.

1   Introduction

Teaching styles reflect the beliefs and values that teachers hold about the learners' role in learning while learning styles provide insight into the ways learners perceive, interact with and respond to the environment in which learning activities occur (Heimlich and Norland, 2002)

Over the last three decades various theories of learning styles have been proposed in which learning styles have been categorized, defined, and analyzed. Gardner (1983) proposed the theory of Multiple Intelligence, in which seven separate intelligences are described: linguistic, logical mathematical, spatial, bodily-kinaesthetic, musical, interpersonal, and intrapersonal. As a cognitive model, the core of the theory of Multiple Intelligences is the belief that 1. Each person possesses all seven intelligences; 2. Most people can develop each intelligence to an adequate level of competency; 3. Intelligences usually work together in complex ways; and 4. There are many ways to be intelligent within each category.

Another well-known learning styles model is the Myers-Briggs Type Indicator (MBTI), which measures the dimension of learning (Brown, 1996). The MBTI categorizes individuals into 16 different types of personalities based on the way how they view their environment, make decisions, focus on the inner world of ideas and concepts or the outer world of people and things, and respond to situations with acceptance or judgemental attitude.

Another model is Bipolar Construct of Field Dependence and Field Independence (Brown, 1996), which measures the extent to which a learner is influenced by a surrounding field.

Asselin and Mooney (1996) used brain hemisphericity to distinguish between right brain (global) and left brain (analytic) learners.

The Visual-Auditory-Kinaesthetic (Modality Preference) model focuses on the modes or senses through which people take in and process information (Wills, 1999). It is a perceptual, instructional preference model that categorizes learning by sensory input preferences. Sensory preferences can be assessed by the instrument of Multi-Modal Paired Associates Learning Test (MMPALT).

Another instrument used to identify modality preferences is the VARK Learning Styles Inventory (Fleming and Mills, 1998). The VARK Learning Styles Inventory provides a perceptual learning style profile for each student. The acronym VARK stands for the Visual, Auditory, Read/write, and Kinaesthetic sensory modalities used in learning.

The Modality Strengths Model indicated that modality strengths (the superior functioning of visual, auditory, and kinaesthetic channels of learning) are more important in planning instruction than learners' modality preferences, which may not match their strengths. According to the Modality Strengths Model, modality strengths are not fixed and usually change over time.

Rita and Ken Dunn have developed a model of learning styles that incorporates a wider range of dimensions than most (Dunn, Bearudry. and Klavas, 1989). They have 21 separate scales that are subdivided into five separate categories: Environmental includes people's preferences regarding light, sound, temperature, and environmental design; Emotional includes motivational structure, persistence, responsibility and structure; Sociological includes self, pair, peers, team, adult, varied; Physiological includes perceptual mode, food intake, time and mobility; Psychological includes global/analytic, hemisphericity, reflective/impulsive .

The issue of learning styles is becoming increasingly important because researchers discovered that by recognizing the diversity of learning styles in instructional design student learning can be improved. Willis (1999) suggests that both the quality and quantity of learning increase when a student is enjoying the process. According to O'Neil (1990), students learn best through direct actual experience, cooperation and collaboration, and with high levels of interaction. Much research supports the view that students' motivation and achievement usually improve when their learning preferences match their instructor's teaching style (Wilson 1998; Miller 2001; Stitt-Gohdes 2003). Other studies show that matching teaching and learning styles is not an effective determinant of the best arrangement for adult basic skill learning, primarily because learning styles may differ according to age and other situational factors such as the type of class or subject being studied (Spoon and Shell 1998).

Further research shows that adaptability, versatility, stretch and interaction that relate to learning styles should also be considered during instruction. To meet the needs of various learning styles, by either to matching different learning styles, or to allowing students to experience various learning styles so that they can adapt to them, becomes an interesting, yet challenging research question in a traditional classroom setup.

Difficulties of dealing with various learning styles lie within the following facts:
- Most schools are learning style biased: they teach mainly to one type of learning (Willis 1999), partly because
- Just as students have different learning styles, teachers have distinctive teaching styles;

- Each person has more than one way of learning. Most of us have predominant clusters, preferred channels, and secondary, subordinate approaches.

It is often impossible for a teacher to change his/her teaching style during a lecture to suit different learning styles of students.

In this research, the concept of Reusable Learning Objects (RLOs) is introduced to solve the problem. The idea is to package and deliver the same course materials in different ways according to requirements of different learning styles.

2 Statement of research problem

2.1 Reusable Learning Objects

Although the term RLO is rarely used by professors, the practice underlying RLO's is commonplace. Unfortunately, the collaborative nature of RLO's has had scant systematic practice on most campuses. As individual professors preparing a course, we often find ourselves searching through our personal computer files for some material (objects) we may have written for a prior semester's class that can be used again in another class with either slight modification or no modification. Not only do we waste time either searching for or re-creating these objects, we rarely have any opportunity to see similar objects other professors have created that may fit the learning needs of students in another courses.

Attempting to practice technology-supported collaboration among the NSU teaching community by placing RLO's in a campus-wide, web-based accessible repository brings the challenge of developing the specifications for identifying and depositing the RLO's. In order to meet this challenge, this grant will fund the development of the metadata to identify each learning object as well as the development of a user friendly interface to assist any member of the NSU teaching community with depositing a RLO into an accessible repository.

Although there have been attempts to create widely accessible repositories by such organizations as the Multimedia Educational Resource for Learning and On-Line Teaching (MERLOT) project, they have not taken care to consistently develop RLO in small enough objects. This grant project will specify RLO's as atom-like, digital objects that can be reused or recombined to support learning. One of the definitions given by Academic ADL Co-Lab is as follows:

"Learning objects [are] self-standing, reusable, discrete pieces of content that meet an instructional objective. Learning objects may be tagged with meta-data so that users can easily identify and locate specific learning objects in a Web-based environment."

As more and more faculty make use of WebCT or other web based, digital technologies to support their teaching and enhance student learning, the benefits of this project become obvious. With a repository of well-described RLO's any member of the NSU teaching community can easily access a learning object to incorporate into a course or an instructional activity.

In a traditional classroom environment, course materials are prepared individually as large structures that are difficult to repurpose into searchable and reusable objects. For example, a course could be composed of several lectures, with each lecture composed of many slides in Microsoft Power Point format. For such a course structure, it is quite difficult to identify a

particular slide inside a Power Point file that might be used for other lectures or even other courses. Even if the slide is believed to be inside a particular file, the only method of locating this slide is to go through the whole file.

Therefore, course materials prepared in this way cannot fulfill the need for similar knowledge and skills to be taught in media driven environments such as Web based online teaching and learning. Reusable Learning Objects are proposed to address this problem.

Reusable objects are quite popular in the fields of human technology and knowledge information management. Other terms used in the industry include:
•   Educational objects
•   Learning objects
•   Content objects
•   Training components
•   Nuggets
•   Chunks

Now, this concept has filtered into the field of education (Bannan-Ritland, Dabbagh & Murphy, K., 2000, Bratina, Hayes & Blumsack, 2002, Martinez, 2001, Sumner, 2002, Wiley, 2001). Some educational researchers argue that the time a professor saves developing already existing material is better spent interacting with students. However, besides saving time, RLOs can be applied in other ways. For example, without any assistance from outside, a professor could not physically adapt to so many learning styles, not to mention to explore various learning styles and find the best for each lesson and course. RLOs can be introduced to package learning materials according to the specifications of various learning styles.

2.2   The Research Problem

The research question can be fomulated as: will exposure to RLOs that have been tailored to specific learning styles result in deeper understanding of core concepts and improving their attitude to the learning materials presented in RLOs?

3   Methodology

The subject of this research is students taking ARTE 310: K-8 Art Methods. Therefore, a suitable model of learning style is VARK. The research consists of three steps: 1. identify different learning styles; 2. develop and deliver RLOs for different learning styles; and 3. Conduct experiments.

3.1   Identifying Different Learning Styles

VARK Learning Styles Assessment instrument is applied to group students into four sub-groups based on their VARK scores. The VARK divides learners into the following styles: Visual, Auditory, Read-write, and Kinesthetic. The style with highest score in the assessment will be considered as the preferred learning style for the student. In the experiment, if two styles or more share the same score, a randomly selected style from the ones with highest score will be considered as the preferred learning style. VARK does recognize that many students are multimodal, an aspect that will be explored in future research.

3.2 Developing and Delivering RLOs for Different Learning Styles

Each sub-group will have access to a password protected website running in our LMS (WebCT). Each website will contain RLOs targeted for one particular learning style. While the RLOs will vary from site to site, they will all cover the same foundational concepts: The Elements of Art and The Principles of Design. We have chosen this pair of concepts because they are so foundational to the student's ability to discuss and critique art, and because, historically, these have been difficult concepts to comprehend for students with little of no previous exposure to the arts.

A visual example of lines is shown in Figure 1, where different shapes of lines are presented in a picture embedded in a HTML file. There is a link on the bottom page to more examples of lines.
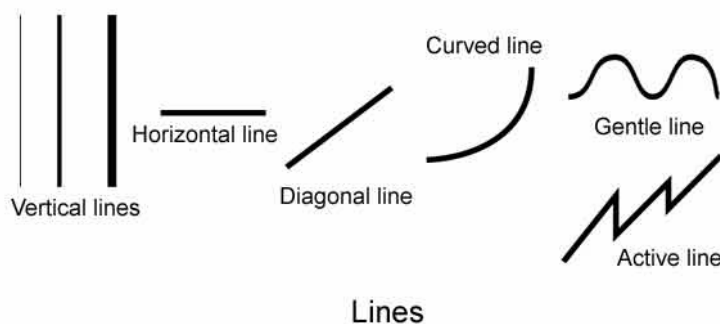
Figure 1. A Visual Example of the Element of Arts – Lines

An auditory example of explanation of concepts of lines is presented in Figure 2. The picture part in Figure 2 is a snapshot of a video clip where Prof. McKinney was explaining lines. Students have the opportunity to view the explanation in words, but the video clip window is set right on top of the word part to catch their attention.

Let's start by reviewing some definitions. What are the Elements of Art? LINE. Lines are everywhere. In math, line is sometimes described as a moving point. As artists, we are concerned with the trail that a point leaves behind when it moves. Lines may be two-dimensional, for example if you use a pencil on paper, three-dimensional if your using wire, or they may constitute the edge of a shape or form. This edge is

Figure 2. An Auditory Example of the Element of Arts – Lines

LINE. Lines are everywhere. In math, line is sometimes described as a moving point. As artists, we are co
trail that a point leaves behind when it moves. Lines may be two-dimensional, for example a pencil on pape
(wire), or they may constitute the edge of a shape. This edge line is often referred to as an outline, a contou
silhouette.

Lines can express feelings and moods. Lines can enclose a space, show direction, make a shape, and, whe
together, create Texture and Value. Not only are lines everywhere, but they come in a wide assortment of t
rough, curved, jagged, zig-zag, wiggly, and spiral to name a few. Lines also have direction, vertical, horizor

Figure 3. A Read-Write Example of the Element of Arts – Lines

In Figure 3, the concept of lines is explained in text only. Students can gain understanding of the concept only by reading through the paragraph.
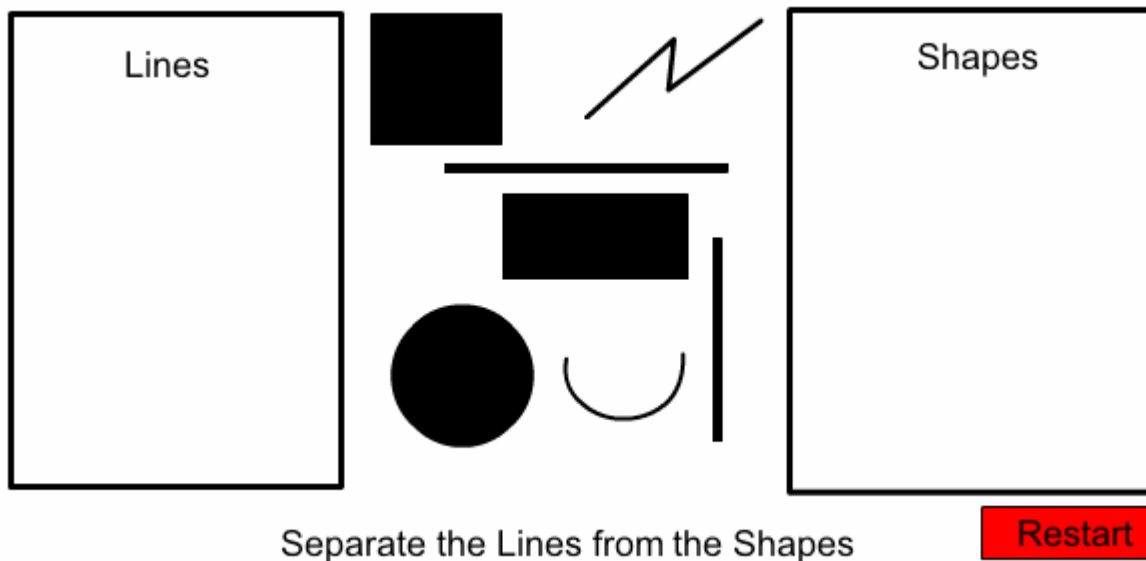
4a. Before students perform any operations
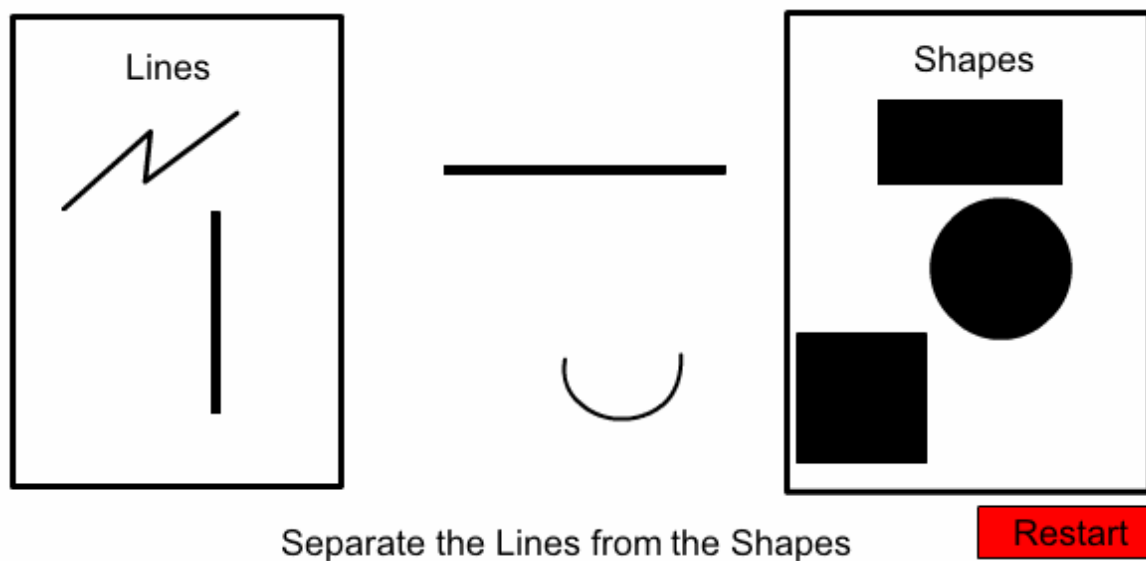
4b. After students perform some operations of seperating lines from shapes

Figure 4. A Kinesthetic Example of the Elements of Arts – Lines

A kinaesthetic example is presented in Figure 4. While presented to this page, students are asked to select and move ("drag and drop") lines to the box on the left side, and select and move shapes to the box on the right side.

3.3 Design of Experiments

An experiment is designed to examine the progress that students make using RLOs. The experiment consists of three tests: a pre-test, post-test, and final test. The experiment procedure is as follows: The pre-test will be given at their initial class session, along with the VARK assessment. The class lecture that day will be on the core concepts of the experiment. After the lecture students will take a post-test consisting of the same questions as the pre-test but in scrambled order. During the class period the VARK questionnaires will be graded, and the primary learning style for each student will be assigned. In the case of a tie score the student will be randomly assigned to one of the learning styles with highest score. Statistics for secondary styles and incremental modalities will be recorded but are not expected to be considered for this particular experiment. Only DataTell numbers will be used to identify students.

Students will have one week to study their notes, books, and RLOs on the website. At the beginning of class one week later they will take another test on the core concepts. This test will consist of the same questions but will be reordered again.

The control group will be given both the pre-lecture test and the post-lecture test during the first class period, and will take the one week test also, but will not have had access to any of RLOs on the website. It is presumed that any increase in score from the post-lecture test to the one-week test will be the result of studying the textbook and student notes. This can be used to factor in an average for conventional study.

The on campus LMS allows us to track student use of the websites. We can track each student by number of visits and by time spent on each page.

4   Results and Conclusion

4.1 Data Analysis

Forty-one students participated in the experiment. They were divided into two groups randomly: a control group with 8 students, and experimental group with 23 students. We accepted the disparate ratio between the class sizes because the experimental group was divided among four types of learning styles.

The distribution of learning styles is presented in Figure 5. The Kinesthetic learning style was dominant with 15 students, while Auditory had 4 students, Read/Write and Visual each had 2 students.[1] It is not clear why Kinesthetic is the dominant learning style. Since the purpose of this experiment is to examine if the matched learning styles can improve students' performance, the question how each learning style is presented in student body is not pursued here.

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[1] Two students score the same in V and A styles. One is assigned as V, and the other is assigned as A style.
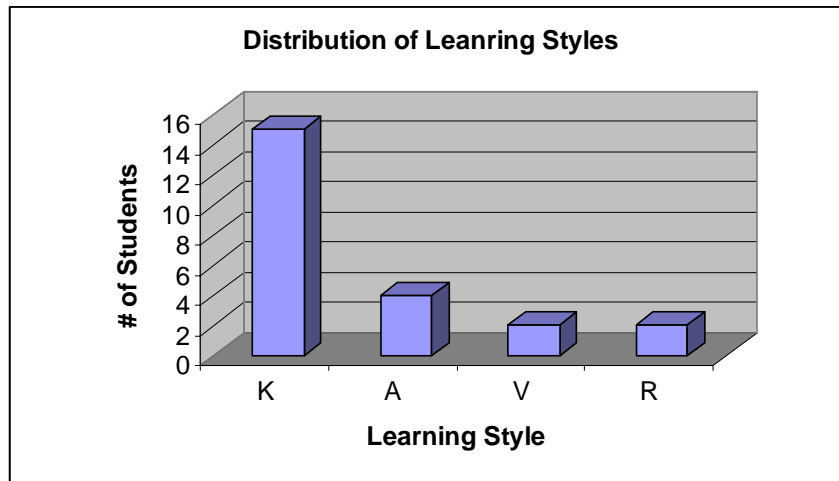
Figure 5. Distribution of Learning Styles in the Experimental Group

K – Kinesthetic   A – Auditory   V – Visual   R – Read/Write

Although each of the students in the experimental group has access to the RLOs on the web, they were asked if they accessed these RLOs during the one week time between the post-test and final test. Due to various reasons, such as no internet connection at home and lack of appropriate software, only 11 students used the RLOs. In the control group, 6 students finished both tests. The relatively small number of students who went through the complete procedure of this experiment could not yield statistically meaningful result, however it may be possible to induce some trends from the data collected.
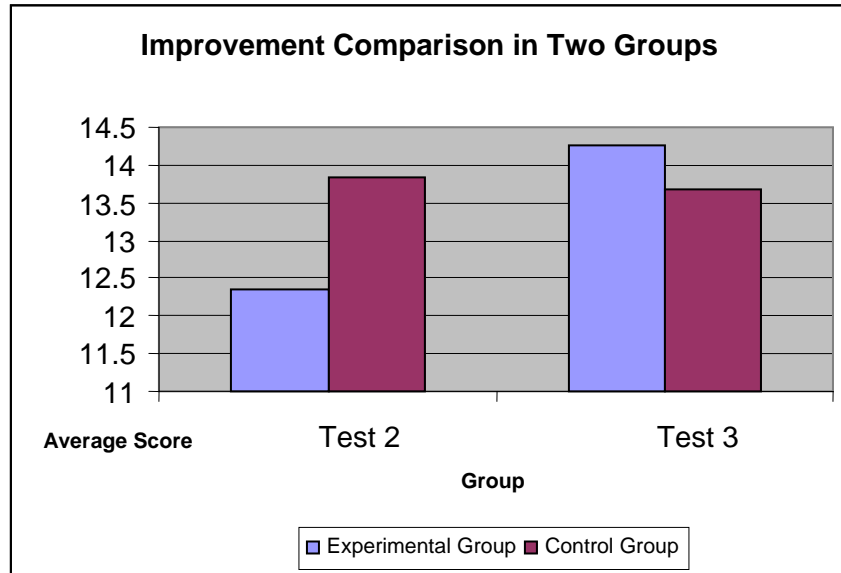

Figure 6. Improvement Comparison between Control and Experimental Group

The performance comparision control and experimenal group is presented in Figure 6. The exprimental group has a lower average score in post-test, but has a larger improvement (15%), and therefore, has a higher average socre on the final test. The control group, instead of making any progress, produced a net decrease in average score on the final test.

An attitude survey (See Appendix I) was completed for students who participated the experiment. Students who had access to the RLOs on the web slightly agreed (average 3.25,

with 1 being "not at all" and 5 being "extremely helpful") that the RLOs can help their learning.

4.2 Conclusion

In this research, the concept of Reusable Learning Objects is introduced to solve the problem of learning styles issues. The same learning materials are packaged to suit the needs of different learning styles. Due to the small number of students who completed the experiment, no statistically meaningful result has been obtained. However, from the trend shown, the research does indicate that the students in the experimental group performed better than the control group. Students agreed that the learning materials presented in various learning styles can be helpful. More importantly, using RLOs in a classroom provides a platform so that instructors can choose what strategy to apply while implementing different teaching styles. Specific content objects could be either match with individual student's learning styles, or lead students to the best suitable learning style for the specific subject.

The next step in this research is to create an XML engine that will take a student's VARK profile and sequence mixed style RLOs into a pattern that is logical for that student.

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Appendix I Test Questions for VARK Project (ARTE 310)

1. Hue is another name for:
   A. Value; B. Color; C. Contrast; D. Spectrum
2. Value refers to:
   A. degrees of darkness or lightness; B. intensity of reflected light rays; C. Relative dominance;
D. Shape
3. Points on a continuous path form:
   A. calligraphy; B. harmony; C. A line; D. A 3-D shape
4. An artist who uses a complementary color scheme is counting on this principle to help make a
visually appealing work of art.
   A. Harmony;   B. Emphasis; C. Hue; D. Variety
5. An artist who uses only the same width and color of line throughout an artwork will probably
achieve:
   A. Harmony;   B. Emphasis; C. 3-Dimensions;   D. Variety
6. Using repetition of forms an artist creates:
   A. Emphasis;   B. Patterns and Rhythm; C. Hue;   D. Variety
7. Educators most often use this diagram to help students understand the relationship between
colors of the spectrum:
    A. Radial balance;   B. The Color Wheel; C. A portfolio; D. A triangle
8. The art principle that makes all separate elements of an artwork look as if they belong together:
   A. Unity; B. Emphasis; C. Overlapping; D. Triangulation
9. Using a wide range of values in a composition helps give the illusion of:
   A. symmetrical balance;   B. The 3rd dimension; C. Harmony;   D. Hue
10. The principle of art that directs and centers our attention on one significant part of an artwork
is:
   A. Harmony;   B. The Color Wheel; C. Repetition;   D. Emphasis
11. An amorphous shape is:
   A. Always solid;   B. Never a geometric shape; C. One made up of warm colors;   D. Always
small
12. To make a tint of a color one must add:
   A. The complementary color;   B. A neutral color; C. Black;   D. White
13. To make a shade of a color one must add:
   A. The complementary color;   B. A neutral color; C. Black;   D. White
14. A contour line can be used to show:
   A. Elevation;   B. A diagram; C. The horizon;   D. Actual texture
15. Texture:
   A. Is always physical;   B. Can be both actual and implied; C. Is associated only with sculpture;   D.
Is a principle of Art
16. The bordering edge of a shape is called:
   A. The hue;   B. An outline; C. The primary edge;   D. Negative space
17. The primary colors are:
   A. Red, white & blue;   B. Red, green, & yellow; C. Red, yellow, & blue; D. Blue, green & red
18. Symmetrical balance:
   A. Is necessary to accomplish unity; B. Is also called formal balance; C. Is only found in nature; D.
Always lacks emphasis

Appendix III Attitude Survey for ARTE 310/VARK Project

ARTE 310/VARK Project

Do NOT put your Name on this page

To cross reference your statistics we need your DataTell number _____

Y   N   Did you access the WebCT site during the test period?

Y   N   Do you feel that the supplemental resources helped your understanding of

the core concepts covered?

Y   N   Do you think the materials you had access to would be suitable and relevant for
K-8 classroom teaching?

On a scale of 1 to 5, 1 being "not at all," 5 being "extremely helpful," how would you rate the
usefulness of the supplemental resources

1   2   3   4   5

Please add any comments that you might have.

Thank you for your participation in this research project.

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