*The attached document contains the proposed Delivery Models for each of the ten Curricular Templates of the proposed General Education Curriculum (Appendix A). It also contains various illustrations, bibliographies, and other supplementary materials to amplify the information contained in the Curricular Templates (Appendix B).*

# APPENDIX A – DELIVERY MODELS

## I. Intellectual Inquiry

### A. Intellectual Inquiry in the Humanities

To deliver these courses, which are heavily dependent on discussion and writing, each course should contain no more than 30 students. If it is absolutely essential to have larger enrollment courses, the courses should be capped at 60 to allow for no more than 20 students per teaching assistant/instructor in the break-out groups. This distribution will allow for more intensive writing assignments and involved discussion. It is anticipated that the courses will be offered from the 100 to the 300 levels, although primarily at the 100-200 level. They will be open to non-majors and have no pre-requisites.

### B. Intellectual Inquiry in the Natural/Physical/Mathematical Sciences

The Science Inquiry Curricular Team was aware that when it included a hands-on project requirement that this would entail extra work for the instructors. We considered this issue.

Our Team was won over, by a number of positive factors, such as:

- current K-12 science learning outcomes stress the importance of hand-on activities and ours is a simple extension of that curriculum;
- these activities add life to a course that doesn't have a lab component;
- the structure of science is inherently based upon observational methods, so a one-time introductory science class should rightly include this component;
- a science course that involves a project with a written component will strengthen the writing component of the overall curriculum,

The majority of the current USP Science courses are taught as large enrollment courses (150 – 300+ students). Anticipating that the new Gen Ed Science Inquiry courses will also be large enrollment courses (100+ students at a minimum), the Curricular Team members have provided examples of hands-on projects (with anticipated costs) that could be incorporated into a Gen Ed Science Inquiry course. See Appendix B.

### C. Intellectual Inquiry in Social Sciences

Departments and multidisciplinary teams offering General Education courses in the social sciences should be encouraged to experiment with varying delivery models, including (but not limited to) (a) large (150 +) lecture sections with varying combinations of discussion or (where appropriate) laboratory sections and assistance from Teaching Assistants, (b) medium-sized (75-150) lecture sections with assistance from Teaching Assistants, and (c) smaller sections. Appropriate delivery may vary by discipline (or multidisciplinary combination), but it will be the case in all departments that instructors of sections of General Education courses in the social sciences cannot reasonably be expected to fulfill expectations for active learning and the development of critical thinking skills without adequate assistance and support. This will include Teaching Assistants as well as access to smart classrooms and other appropriate technical support.

### D. Intellectual Inquiry in Arts & Creativity

- Many existing courses (e.g. Art Studio courses, Design courses, creative writing) are currently offered with enrollments of 20 or less. It is expected that this will continue and that many new courses in this area of Inquiry will be in this format.

- It is possible that courses can be designed using the large lecture/breakout format.

- A majority of the courses will be offered at 100 or 200-level, though we anticipate some courses at 300-level or above.

- Most courses in this area will be open to enrollment for non-majors, with no pre-requisites.

## II. Composition and Communication I & II

***Delivery Models:***

Integration of Oral, Written, and Visual Communication. It is beyond the purview of this committee to determine the structure under which the integrated communication sequence should be administered. Such conversations should take place in collaboration with the deans of the two primary colleges (Communication and Arts & Sciences), department chairs, faculty, Undergraduate Studies, the Office of the Provost, and the University Senate (as well as other stakeholders). In this conversation, national models and UK resources should be further studied. These conversations must recognize the dual

imperatives of excellence in undergraduate instruction and graduate education, particularly in English and in Communication.

Given these parameters, the curricular teams recommend the formation of an integrated center for training TAs and other instructors for the Composition and Communication courses, co-directed by faculty leaders in the Writing Program and Department of Communication. A center would

- allow for the sharing of administrative support and teaching staff and coordination of learning outcomes of the courses;
- "establish an academic staffing model based on national best practices with an optimal mix of Teaching Assistants and full-time [and part-time] faculty, including clinicians and lecturers" (taken from Objective 1.2 of the University's proposed strategic plan);
- be an ideal venue to train and evaluate instructors, to assess curriculum and instruction; and to suggests ways to incorporate effective information literacy research skills, which are an integral component of the courses; and
- encourage collaborative research opportunities in the area of instructional assessment.

The curricular teams suggest that, in the event that a Center is deemed feasible, clear memoranda of agreement be established with departments whose graduate students will teach Composition and Communication courses.

Class Size. According to the National Council of Teachers of English (NCTE), students should learn to write in small classes of no more than 20 students per section. Because teaching composition and communication responsibly is labor-intensive, small class size is critical to student success. NCTE further recommends that college instructors teach no more than 60 students per term. Currently, the Writing Program is able to cap its first-year writing courses at 22 students per section, and some full-time lecturers teach up to 88 first-year students per semester. We recommend that the University of Kentucky adopt the NCTE guidelines for course enrollment and instructor load, but in no case exceed the current limit of 22 students for either course. Graduate student teaching assistants (TAs) should teach no more than 66 students per academic year. The success of this curriculum depends upon these labor models.

Instructor Training, Qualifications, and Observation. To honor the interdisciplinary intent of the courses, TAs and other instructors of the course should be drawn from more than one discipline. The Southern Association of Colleges and Schools requires graduate students to earn 18 credit hours of coursework in the discipline before teaching undergraduate courses, so most of the pool of TAs are likely to be drawn from—but not limited to—disciplines that are deeply engaged in the teaching of writing and communication.

Implications for Other Existing Resources. Expansion of campus-wide training in oral and visual communication has implications for the existing Writing Center and, in the longer term, the Writing Initiative. Communication across the Curriculum (CXC) is the cutting edge, so moving these units toward the CXC model could make the University of Kentucky a model for institutions across the country.

# III. Quantitative Reasoning

### A. Quantitative Foundations

Courses of this kind introduce students to a new language or to a more sophisticated use of mathematical or statistical skills than they may have encountered in high school. In a real sense this is akin to learning a foreign language. Classes of 25-30 students afford the best conditions to support this kind of learning, but if this is not economically feasible and a large lecture format is contemplated, there must be at least one recitation type class per week devoted to amplifying or clarifying lecture materials, to addressing particular students' questions, and to providing guided practice in the subject matter. These should be taught by TA's well grounded in the subject—preferably advanced TA's. Departments must have the resources (including designated faculty time) to provide regular initial training for these TA's and coordination and supervision through the semester.

An analysis must be made to anticipate potential changes in course enrollment patterns as students shift from the USP Inference requirement to the Gen Ed QR requirement. It is desirable and imperative to invite and encourage many departments to offer courses meeting the new requirements.

### B. Statistical Inferential Reasoning

- Large lecture classes alone are not recommended. Lectures, perhaps meeting once or twice a week, with recitation breakouts are a better solution. While class size may end up being the purview of individual departments or colleges, it does have implications for the comparability of the different assessments that may be embedded across departments and colleges.

- Teaching assistants will be needed to help staff the recitations. These TAs will need to be trained and departments will need resources to create and sustain effective training programs.

# IV. CITIZENSHIP

### A. Community, Culture and Citizenship in U.S.

The committee feels that this template would fit a range of class sizes, from small seminars to large lecture courses and, therefore, resources will need to be considered in light of the size of class to be taught. Teaching Assistants will be

required for larger courses, and/or courses initiating innovative pedagogical techniques.

The courses taught according to this template will require smart(er) classrooms, and course development support (such as workshops and seminars). In addition, instructors are encouraged to cross-list courses (for example, courses within special programs should be able to cross-list with departmental offerings), and to seek librarian involvement (for example, regarding information literacy).

B. **Global Dynamics**

In satisfying this component of the new General Education curriculum, courses may be offered at the 200-, 300- or 400- levels. Class enrollment size would generally range between 50 and 150 from one department to another. For courses with enrollments of 100 or more, a teaching format involving two lectures and one discussion section per week would be followed and ample TAs would be supplied to cover the discussion sections. All courses meeting this requirement would assign an individual or team project, which would both: (1) be included as part of the final course grade; and (2) act as the means for assessing the courses success in meeting the learning outcomes specified in the new General Education curriculum.

# APPENDIX B – ILLUSTRATIONS, RESOURCES, ETC.

**CONTENTS:**



## I. Sample projects, Natural/Physical/Mathematical Sciences

**Earth and Environmental Sciences**

For Earth and Environmental Sciences courses this could involve utilization of climate data (ice cores, geochemical parameters recorded in the rock record) or earthquake location/intensity data available, e.g., through the U.S. Geological Survey. A hypothetical course might be: Gambling on the Big One: Earthquake Risks and Prediction

The course would focus on seismic hazard risk assessment and prediction. Lectures and readings would provide content background. There would be five blocks of work time (~2 lectures) in which groups of 5 students would first access and download data sets, organize and plot data (depth and spatial distribution of earthquakes in the crust), intensity distribution of earthquakes, determine recurrence intervals of events of various magnitude, and assess precision of all measured parameters. Students would use standard spreadsheet/ statistical/graphing software (Excel).

This would require 20 laptops/ 100 students accessing on-line datasets via the campus the wireless system.
One TA / 100 students

**Physics**

There are many sound-related projects which students can do at home, some of which involve using software available for free on the web. Students have analyzed the sound made by their voice, their guitar,
and by birds, for example. Other home projects involve various optical effects students can investigate, such as interference -- observed with soap films on water, diffraction and refraction of light, or a study of
the colors of the sunset. Students can obtain and characterize small systems of lenses, or study the effects of using the polarizing lenses in their sunglasses to look at scattered light.

It is estimated that 1 full-time TA would be needed for every 100 students in these classes. Their assignment would be to meet with the students to discuss their project ideas and plans, and to grade the final papers. To maximize efficiency, the project assignments could be staggered across the class
over the first half of the term, and collected and graded over the last half. TAs could meet with 15 students for each of the first 7 weeks, and grade the papers of 15 students in each of the final 7 weeks.

**Medicine**

Biofeedback training and execution

In the near future, neuro-prosthetic interfaces may be used to control devices and machinery, in contrast to mice, joysticks and remote controls. This laboratory will allow students to explore biofeedback as an approach to developing electronic interfaces of the future, whether they are household devices, prosthetic limbs or wearable electronics. Neuro-prosthetic interfaces require a training period to align the biological or neurological responses to the output and an execution phase to implement the device. Students will learn about neuro-prosthetic interfaces, the biology of learning & memory, and the scientific method.
Students will be given the opportunity to integrate biofeedback sensors (EMG, EEG, etc.) with standard computer software.

DESIGN: Groups of 10-15 students would receive an introduction to the biofeedback equipment and train on standard computer interface software. Independently, the groups will choose several variables to manipulate (e.g. position of sensors, direction of the sensors, and difficulty of the task). Quantitative measures will be recorded, including time to criterion performance, number of errors, and permanence of task performance.

OUTCOME: Students will be introduced to the scientific method using biofeedback electronic control that is likely to become more common in the future. Students will gain an understanding of trial and error learning, persistence of learning, and reversibility of learning.

RESOURCES:
1. Small classroom/laboratory setting
2. Biofeedback hardware (sensors, control module)
3. Software

**Biology**

This activity is used to introduce the students to a soil erosion unit in the Human Ecology (BIO 102) course (current USP course) and involves the students conducting a soil survey of the state. Students collect soil samples from around the state of Kentucky. The students, in groups of 8 – 10, test these samples for nitrogen, potassium, phosphate and pH (using commercially available soil test kits). They also determine the relative fertility of the soil samples, and conduct an animal and microbial inventory of the soil samples. This activity is used to introduce the students to the soil erosion unit of the Human Ecology (BIO 102) course. During later class periods, the results obtained from the soil tests are used as a basis for the lecture. The students use their results to hypothesize on the relationship between the chemical levels and the relative fertility of soil. Each student submits a written report of the activity and each group orally shares their results with the rest of the class.

Another activity focuses on the problems associated with water pollution. In order to sensitize students to the impact of even small amounts of pollutants on water ecosystems, the unit begins with a water pollution experiment. In this activity, students test the effects of common household fluids and waste on water quality. During later class periods, the results obtained from the water pollution tests are used as a basis for the lecture.

Both of these activities have been successfully carried out with 300 students in a lecture hall during a 50-minute class period with the assistance of only one teaching assistant.
Estimated cost $100.00/ 300 students

**Rehabilitation Sciences**

**Topic:** Sensory Mapping and Tactile Perception
**Goal:** Assess the distribution and sensitivity of tactile sensory endings on human skin throughout the body surface using an adjustable two-point discrimination assessment tool.

**Procedure:** The class is divided into pairs, with each student operating as a subject on one turn and a tester on a second turn. An adjustable 2 pt assessment apparatus (left picture) is touched to the skin site in question and the subject (who is blind-folded) is required to respond with the words “one” or “two” to indicate their perception of the event delivered by the tester. The response is recorded and the testing cycle repeated with a different inter-point distance. Inter-point distances are adjusted in 1 mm steps (up and down) to find a perceptual threshold point, defined as the distance at which a subject is able to detect two distinct points 50% of the time within a pre-determined number of trials. The procedure is repeated for different body parts (leg, arm, back, face, fingers, etc). Data can then be complied across the entire class to build a 2 pt sensitivity map of the body surface. Simple descriptive statistics could be run to provide quantitative insights and the data can be compared to published reports on tactile sensitivity.

**Resources:** 2-point tools are low-cost items than can be ordered through most science supply catalogs. For a class of 300, you would need 150 sets for each pair of students. Approximate

cost for supplies = $5.000. This would be a onetime initial cost, since these devices can be reused in subsequent semesters. Alternatively, a set of 2 pt testers can be made from simple household items if desired. This hands-on project can be performed either in or out of class. A TA trained in 2 pt assessment would be useful to field questions from the students. The TA would only be needed for those class periods or time periods when the project was being conducted during the semester.

**Chemistry**

Do pesticides break down at the same rate? Does the rate depend on the pH?
This exercise addresses the question of whether chemicals break down at an observable rate in the environment. Depending on the specific focus of the course, students can address the question of whether different chemicals (in this case commercial pesticides) behave in the same manner, whether different soils lead to different rates of chemical degradation, or others.

Students collect soil samples in plastic vials. To one is applied a small amount of a dilute solution of Roundup in water. The other vial functions as a control. After a week or two, the content is analyzed by thin layer chromatography. Ninhydrin stain can be used to visualize the residual compound.

Cost ~$500 for 300 students, plus TA time for preparation of solutions, assistance with the TLC step, and grading.

**Mathematical Sciences**

Example course; Geometry and Symmetry in Nature
The nature of space imposes striking constraints on organic and inorganic objects. This seminar examines such constraints on both biological organisms and regular solids in geometry.

Geometry.
Construct and catalog regular solids (solids whose faces are congruent regular polygons). Count vertices, edges and faces. Verify Euler's relation. Have we found all regular solids? Construct polyhedra with faces that are one of two regular polygons. (Such as the pattern of hexagons and pentagons on a soccer ball.)

Cost: Classroom sets of snap-together polygons for experimentation.
TA's to grade and give guidance.

**Summary of resources needed for the SAMPLE projects listed above:**

- The majority of the current USP Science courses are taught as large enrollment courses (150 – 300+ students). It is anticipated that the new Gen Ed Science Inquiry courses will also be large enrollment courses (100+ students at a minimum),

- That several "general purpose science labs" be made available for Gen Ed Science Inquiry classes on a rotating basis throughout the semester.
- Laptop computers: 20/100 students
- Consumable supplies (chemicals, test kits): $100 - $500/300 students
- Up-front equipment (other than computers): $5000/ 300 students (one –time costs)
- Teaching Assistant support for all courses (average -1 TA per 100 students)

**Curriculum-Embedded, Performance-Based Assessable Product:**

The student product (paper, laboratory report, presentation, etc) based on the hands-on project.

# II. SAMPLE ASSESSMENTS, ARTS & CREATIVITY

Options for assessment include direct and indirect measurements:

Direct: Assessment should be based on artifacts created by students in the course. These artifacts may include records of performance/object or a portfolio in which students document and evaluate the process and products of their work for the course.

Indirect: Assessment could be linked to the current Oswald Creativity contest (an increase in the number of applicants to the competition, an increase in the quality of the applicants work over time)
Assessment could be linked to increased rates of attendance or participation in campus cultural or co-curricular events.
Assessment could be linked to other undergraduate research programs such as eUreKa, Kaleidoscope.

# III. SAMPLE QUESTIONS AND BIBLIOGRAPHY, QUANTITATIVE FOUNDATIONS

**A Few Examples of Potential Questions/Investigations of Varying Complexity**

**1.** [From *For All Practical Purposes*, 7th edition] The framers of the U.S. Constitution wrote that seats in the House of Representatives "shall be apportioned among the several states within this union according to their respective Numbers…" The table below shows the populations of the 15 states in 1790.

[Insert Table]

a. The House of Representatives was to have 105 members in the 1792 apportionment. Use the above populations to apportion the seats, and justify why your method is reasonable.
b. Alexander Hamilton proposed a method of making the apportionment. Study a description of his method. Describe it using mathematical notation and carry it out using the data in the above table. Compare his method to yours.
c. George Washington vetoed Hamilton's 1792 apportionment (the first bill in U.S. history to be vetoed). What were his reasons? Note: Hamilton's method was adopted by Congress in 1850 and used until 1900.

d. Thomas Jefferson and Daniel Webster each proposed a different method of apportionment. Study a description of their methods. Describe them using mathematical notation and carry them out using the data in the above table.
e. Congress presently uses the Hill-Huntington method. Again, study a description of this method, describe it using mathematical notation, and carry it out using the data in the above table.
**f.** Which of the above methods is the most "fair'"? Which of the above methods can lead to unexpected, and perhaps unsettling, results? Study the Alabama paradox of 1881, and proposed criteria for the fairness of proposed apportionment methods. Explain this statement: "No apportionment method that satisfies the quota condition is free of paradoxes."

2. Here is an excerpt from an article in the *Lexington-Herald Leader*, March 10, 2009:

> The children of older fathers scored lower than the offspring of younger fathers on IQ tests and a range of other cognitive measures at 8 months old, 4 years old and 7 years old, according to a study released Monday that added to a growing body of evidence suggesting risks to postponing fatherhood.
>
> The study is the first to show that the children of older fathers do not perform as well on cognitive tests at young ages. Although the differences in scores were slight and usually off by just a few points on average, the study's authors called the findings on children of fathers ages 50 and over were "unexpectedly startling."
>
> "The older the dads were, the slightly worse the children were doing," said Dr. John J. McGrath, the paper's senior author and a professor of psychiatry at the Queensland Brain Institute in Brisbane, Australia. "The findings fit in a straight line…"
>
> By contrast, children with older mothers generally performed higher on the cognitive measures, a finding in line with most other studies…

From this article, is it reasonable to conclude that the sperm cells of older men are less healthy than the sperm cells of younger men, but the egg cells of older women are healthier than the egg cells of younger women?

3. Soda cans are often in the shape of cylinders. Let's designate the height of the can by h and its radius by r.
   a. What is the formula for the volume of the can? Why does this formula make sense?
   b. What is the formula for the surface area of the can? Why does this formula make sense?
   c. Suppose you can make a can with extremely little waste of material and you desire to make a 355 mL can (typical volume of a soda can) with the least

material, and hence the smallest possible surface area. What would the dimensions of the can be?

d. How do these dimensions compare to the commercially available soda cans? Comment on the reasons for any differences you may find.

4. [Example from http://www.fallacyfiles.org.] Consider the following reasoning (taken from the book *Carl Sagan: A Life*): "If 'experts' could always be trusted to make the right moral decision, then public participation would not be necessary. But they cannot be, and so it is."
   a. Is this a valid argument? If not, what's wrong with it?
   b. Write the argument symbolically (use propositions P: experts can always be trusted to make the right moral decision; Q: public participation is necessary) and indicate where the argument goes wrong.

5. Ask a friend to give you any three numbers x, y, and z.
   a. Create a set of numbers for which x is the mean, y is the median, and z is the mode.
   b. Describe a general procedure to solve the above problem that will work for any three numbers.

6. A piano is usually tuned according to an "equal temperament" system—the ratio of the frequencies of every pair of adjacent notes is the same. An octave on the piano is divided up into twelve steps with equal frequency ratios.
   a. The frequency of 440 Hz is assigned to the note A above middle C ("A4") on the piano. One note an octave above another has twice the frequency of the first. So, for example, the note A ("A5") that is an octave above A4 has the frequency 880 Hz. Determine the frequencies of the 13 notes from A4 to A5, inclusive.
   b. Some composers have advocated using a tuning system, in which the octave is divided into 19 equal steps. If an instrument were tuned this way, with A4 tuned to 440 Hz, what would be the frequencies of the 20 notes from A4 to A5, inclusive?

7. [Example from http://www.fallacyfiles.org.] The New York Times reported the following story about the famous statesman Benjamin Disraeli: "[S]harp-tongued Benjamin Disraeli, so the story goes, was ordered in the last century to withdraw his declaration that half the Cabinet were asses. 'Mr. Speaker, I withdraw,' was Disraeli's response. 'Half the Cabinet are not asses.'" Analyze the meaning of Disraeli's earlier statement and his "withdrawal". Why was this a clever response?

8. If you use a global positioning system (GPS) device to determine your location, the device calculates your position on the earth based upon your distance from a number of geosynchronous satellites that are orbiting the earth.
   a. How many satellites are needed to determine your position? For example, one is not enough, because there are many points that have a given fixed distance from one satellite.

b. How does the device determine its distance from a given satellite? What effect do errors in measurement have in the answer to (a)?

9. Find appropriate data and create a table showing the carbon dioxide emissions per person, and also the infant mortality rates, by country. From this data create a graph of infant mortality rate vs. carbon dioxide emissions, plotting a point for each country. Does this graph support the conclusion that high carbon dioxide emission rates are beneficial because countries with higher emission rates generally have lower mortality rates?

10. In the Powerball game of the Kentucky Lottery you choose 5 numbers from 1 to 55 in the "Pick 5" section (white balls), and 1 number from 1 to 42 in the "Pick 1" section (the red powerball).
    a. What is the probability that your choices will match all five white balls as well as the powerball in the random drawing—getting the Jackpot?
    b. Suppose a path of coins, each 1.043 inches in diameter, is strung along the 2400 miles of highway from Lexington, Kentucky to San Francisco, California. Suppose further that one of these coins is an authentic dollar coin, while the rest are all clever fakes. You get to choose one of these dollars at random. Is the probability that you choose the authentic coin greater or less than your chance of winning the Jackpot above?

11. Suppose you have a credit card that requires you to make a minimum payment of at least $25 on your balance each month, but also charges you 1% each month on the remaining unpaid balance, which is added to next month's balance. Unfortunately, you do not pay attention to your spending and end up with a balance of $3000 due. You make a firm commitment not to use this card ever again, and to dutifully send a payment of $25 each month until your debt is cleared.
    a. How many months will it take to do this?
    **b.** What are the terms for your own credit card(s)?

12. *It was the first time that Poole had seen a genuine horizon since he had come to Star City, and it was not quite as far away as he had expected.... He used to be good at mental arithmetic--a rare achievement even in his time, and probably much rarer now. The formula to give the horizon distance was a simple one: the square root of twice your height times the radius--the sort of thing you never forgot, even if you wanted to...* – Arthur C. Clarke, 3001, Ballantine Books, New York, 1997, page 71
    a. In the above passage, Frank Poole uses a formula to determine the distance to the horizon given his height above the ground.
        i. Use algebraic notation to express the formula Poole is using.
        ii. Make a diagram and derive your own formula for the distance to the horizon, given your height h and the radius r of the planet.
        iii. Compare your formula to Poole's; you will find that they do not match. How are they different?
    b. When I was a boy it was possible to see the Atlantic Ocean from the peak of Mt. Washington in New Hampshire. This mountain is 6288 feet high. How far away

is the horizon? Express your answer in miles. Assume that the radius of the Earth is 4000 miles. Use both your formula and Poole's formula and comment on the results. Why does Poole's formula work so well, even though it is incorrect?

13. My grandfather had ancestors who worked in the textile industry in Massachusetts as pattern makers. They were aware that, with respect to symmetries, there were only 17 different types of two-dimensional repeating patterns possible. What does this mean? Bring in some samples of wallpaper patterns from local suppliers (they often have pattern books that they are discarding). How can we classify each of these patterns into the appropriate type? Are some pattern symmetry types used more often than others?

Some References that may be Helpful in Designing a Course


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