Quantitative Reasoning Across the Curriculum
EPR Workshop, 8 August 2006
By Nancy Murray and Vauhn Foster-Grahler

Frequency of Quantitative Reasoning in programs is quantified in the following table.

Breakdown by Planning Group

	Major	Minor	Total	None	Total
Core	16	9	25	11	36
CTL	2	13	15	54	69
EA	1	21	22	14	36
ES	26	19	45	10	55
EWS	25	26	51	33	84
IA	13	25	38	21	59
SI	43	5	48	0	48
SPBC	12	19	31	14	45
TAC	1	0	1	0	1
TRI	2	4	6	1	7
	139	**141**	**280**	**158**	**438**

%Major	%Minor	Total %	%None
44.44%	25.00%	69.44%	30.56%
2.90%	18.84%	21.74%	78.26%
2.78%	58.33%	61.11%	38.89%
47.27%	34.55%	81.82%	18.18%
29.76%	30.95%	60.71%	39.29%
22.03%	42.37%	64.41%	35.59%
89.58%	10.42%	100.00%	0.00%
26.67%	42.22%	68.89%	31.11%
100.00%	0.00%	100.00%	0.00%
28.57%	57.14%	85.71%	14.29%
31.74%	**32.19%**	**63.93%**	**36.07%**

Sub-Disciplines: Statistics, Pythagorean Theory, Space, Hydrology, Problem Sets, Architecture, Game Theory, Algorithm Development, International Market , Currency, Quantum Mechanics, Calculus, Pre-calculus, Physics, Chemistry, Biology, Geometry, Algebra: Boolean, Applied, Evolution, Genetics, Logic, Decision Theory, Special Relativity, Symbol Manipulation, Patterns, Thermodynamics, GIS, Trigonometry, Stock Market, Kinetics, Spectroscopy, Astronomy, Cosmology, Astrophysics, Financial Management, Business , Topology, Comparative demographics, Geography, Music, Qualitative ecology, Movement Theory, Systems Theory, Theoretical math, Applied math, Discrete math, Fermi math, Economics.

Skills: Measuring: magnitude, light, motion, temperature, conduction, alkalinity, volume, anion, resting membrane potential of cells; Estimating; Quantitative Relationships; Computation; Statistics: correlation, ANOVA, chi-square, ordination, significant figures, descriptive, influential, quantitative superstition, distributions, causation, variance, war, census; Unit conversion; Growth modeling ; Data: collection, analysis; Distribution: mean, median, mode, range; Graphing: charts, tables; Analysis; Experimental design; Quasi-experimental design; Math proofs; Hypothesis testing: uncertainty; Calculators; Excel/Spreadsheets; Scale; Size; Vectors; Notation ; Labanotation; Map making; Mutations: random; Allele frequencies; Variation; Navigation/Piloting; Chemical Stoichiometry; Logs; Correlations; Tessellations; Patterns (fiber arts); Ordination; Evolutionary trees: hierarchy, branching; Haplodiploidy; Reagents; Budgeting**;** Accounting; Layout: design, matting, sculpture; Rubrics; Digital volume; Percentage; Land survey; Venn diagramming ; Sampling.

General Teaching Practices and Strategies: Interpreting and Critiquing research papers; Budget preparation; Workshops; Computer workshops: Excel, data software, programming software; Lectures; Labs; Experiments; Fieldwork; Analyses; Using Calculators ; Research projects; Scientific papers; Question framing; Making connections; Creative analysis: pop culture research; Hands-on measuring and calculating; Drawing assignments; Project work; Real-world

problem-solving; Scale model making; Historical graphing and statistics; Debates; Grant writing; Pattern making; Timelines.

Note: Statistics was the most frequent sub-discipline documentation of QR in programs, which paralleled the most frequent teaching practice of Interpreting and Critiquing research papers. Generally, teaching practices were not detailed, which limits transdisciplinary opportunities and sharing of invented pedagogy and specific workshops and project ideas. We noted a number of interdisciplinary themes in faculty responses that were predictable, for example: solar systems, physical systems, economy of energy, class issues, public health, poverty, and environmental policy. Some surprises included: Mystery, science fiction writing, economic conditions of hip hop artists, conversion of 2D to 3D puppets, Islamic art, and the geometry in world indigenous communities.

How might the question be more usefully posed?

A false distinction is established between Math and QR by identifying separate End-of-Program Reviews as Math/Science and Quantitative Reasoning. The distinction led one respondent to write, "I distinguish QR from mathematics as follows: math is essentially symbol manipulation, and the study of relationships. QR is the ability to cast real world problems into the appropriate mathematical symbology; and the inverse, i.e. interpreting a mathematical or statistical result. We did both." To aid faculty in identifying both symbols and relationships in their response, we recommend that one review document be titled Science and the other Mathematics/Quantitative and Symbolic Reasoning. This will reduce the number of NO responses in the "QR emphasis" by programs that identified a major or minor emphasis in Math/Science, and no emphasis in QR. The above listing of sub-disciplines and skills garnered from our reviews is evidence of the faculty's broad definition of QR. The term quantitative embodies quantity or counting, and further, Vaughn Foster-Grahler has determined that "All QR is mathematics but not all mathematics is QR. Combining these terms in one Review document is advised.

Further discussion established that: Mathematics is the discipline that deals with concepts such as quantity, structure, space, relationships and change. According to WA State: Mathematics is a way of seeing patterns, forms, and relationships. The etymology of mathematics from the Greek is: (*máthēma*), *learning*, *study*, *science*, which appears to fit the faculty's recognition of QR in program curricula.

In order to increase the sharing of inventive pedagogy, we suggest rewording the question, "If yes, how was Quantitative Reasoning included in your program" to, "If yes, describe how Quantitative Reasoning was pursued in specific workshops, student project assignments, or other innovative program work."