Syllabus - QuarkNet Data Portfolio I

Course Number: REAL-694-Z13
Course Title: QuarkNet Data Portfolio I
3 Semester Hours Graduate Credit

I. Catalog Description

QuarkNet Data Portfolio I introduces physics teachers to the collection of classroom activities called the Data Portfolio and encourages the teachers to adopt the activities for use in their own classroom. The teachers meet for five days at Fermilab.

II. Course Overview\Teaching Methods

Teachers work in small groups to analyze data from the Compact Muon Solenoid to determine the characteristics of a particle from study of its decay products. Additionally, the groups will explore, discuss, and carry out a number of existing classroom activities. These use data from a number of professional experiments at facilities like Fermilab and CERN. The teachers collaborate to implement one activity to meet their curriculum and local standards.

III. Student Learning Objectives\Illinois Content and Teaching Standards Addressed

- Increase their awareness of activities available in the QuarkNet Data Portfolio.
- Analyze data, draw histograms, and determine the mass of a particle by studying its decay products.
- Choose and modify an existing activity for use with their students.
- Submit a plan to use this activity in their classroom.

The state of Illinois has adopted the Next Generation Science Standards for its secondary science curriculum. Below is a list of those standards, with the ones addressed in this course underlined.

NGSS Science and Engineering Practices Addressed

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

NGSS Crosscutting Concepts Addressed

- Patterns
- Cause and Effect
- Scale, Proportion and Quantity
- System and System Models
- Energy and Matter
- Structure and Function
- Stability and Change

NGSS Disciplinary Core Ideas Addressed

PS2.A Forces and Motion
PS2.B Types of Interactions
PS3.A Definitions of Energy
PS3.B Conservation of Energy and Energy Transfer
PS3.C Relationship between energy and forces
ETS1.A Defining and Delimiting Engineering Problems
ETS1.B Developing Possible Solutions
ETS1.C Optimizing the Design Solution

IV. Units of Work\Text and Required Reading

Participants will meet for one week (40 hours). The Data Portfolio provides background materials for each of the included activities as well as links to a comprehensive bibliography.

V. Class Assignments

Participants will complete an analysis of a sample of data from CERN's Compact Muon Solenoid (10^4 data points). The raw data contain measurements of momentum and energy of products of decaying Z bosons. The analysis steps include calculation of the mass of the Z boson from observation of its decay products. Participants will draw and interpret a so-called Mass Plot of the Z mass. The participants will present a summary of their findings during a poster session at the culmination of their data exploration. Participants will also select an activity from the Data Portfolio for adaptation and later use with their classes. They will submit a plan for using their selected activity.

VI. Evaluation and Grading Procedures

Evaluation is summative and based entirely on the included rubric.At the end of the course, letter grades will be awarded as follows:

A = A score of >15 points on the included rubric
B = A score of 9-15 points on the included rubric
C = A score of 6-8 points on the included rubric

F = A score of <6 points on the included rubric

University of St. Francis College of Education Graduate Grading System

A (4 quality points per course unit) - Excellent. Denotes work that is consistently at the highest level of achievement in a graduate college or university course.

B (3 quality points per course unit) - Good. Denotes work that consistently meets the high level of college or university standards for academic performance in a graduate college or university course.

C (2 quality points per course unit) - The lowest passing grade. Denotes work that does not meet in all respects college or university standards for academic performance in a graduate college or university course.

F (0 quality points per course unit) - Denotes work that fails to meet graduate college or university standards for academic performance in a graduate college or university course.

An "A" student will: ***4 points***	***A "B" student will:*** ***3 points***	***A "C" student will:*** ***2 points***	***An "F" student will:*** ***1 point***
Be a prompt and regular attendant.	Be a prompt or regular attendant.	Be irregular in attendance and show a pattern of tardiness.	Fail to attend.
Lead group discussions during group work on data analysis.	Participate in group work on data analysis by asking good questions.	Perform data analysis via "copy & paste" without comprehension of important details.	Fail to participate in data analysis discussions or calculations.
Design and contribute to elements of the group's poster.	Prepare data products or graphics or text for the poster.	Provide minimal contributions to the discussion of the poster design.	Fail to participate in the assembly or design of the group poster.
Actively participate in group discussion or exploration of classroom activities.	Provide minimal discussion or feedback during exploration of classroom activities.	Work independently in exploration of classroom activities.	Fail to explore the selection of classroom activities.

Work independently to modify or improve the activity for use in their classroom.	Work independently to align activity with local curriculum and standards.	Use provided activity with no alignment to local curriculum and standards.	Fail to identify an activity for classroom implementation.

VII. Attendance Policy

Students are required to attend all classes and to participate in class discussions, small group activities, experimental and experiential group exercises and projects.

VIII. Academic Honesty and Integrity

Students are expected to maintain academic honesty and integrity as students at the University of St. Francis by doing their own work to the best of their ability. Academic dishonesty (cheating, fabrication, plagiarism, etc.) will result in the student receiving a zero for that test, assignment or paper.

IX. Final Examination Policy

There will be no final examination. Final reports and accompanying material serve as the final evaluation.

X. American Disabilities Act

Students who have any condition, either permanent or temporary, which might affect their ability to perform in this course are encouraged to inform the instructor at the beginning of the course. Adaptations of teaching methods, class materials, including text and reading materials or testing may be made as needed to provide for equitable participation.

XI. Bibliography

Lederman, N., & Lederman, J. (2004). Revising Instruction to Teach Nature of Science: Modifying Activities to Enhance Students' Understanding of Science. *The Science Teacher*, 71(9), 36-39.

National Research Council (2012). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academy Press.

Reiser, B., Berland, L, & Kenyon, L. (2012). Engaging Students in the Scientific Practices of Explanation and Argumentation: Understanding *A Framework for K-12 Science Education*. The Science Teacher, 79(4), 8-13.

I. References

Abdul-Haqq (1997). *Professional development schools: Weighing the evidence*. Thousand Oaks, CA: Corwin Press.

Carroll, T. (2009). The next generation of learning teams. *Phi Delta Kappan*, 91(2), 8-13.

Darling-Hammond, L. & Bransford, J. (Eds.) (2005). *Preparing teachers for a changing world: What teachers should be able to learn and be able to do*. San Francisco, CA: Jossey-Bass.

Darling-Hammond, L. (2006). *Powerful teacher education lessons for exemplary programs*. San Francisco, CA: Jossey-Bass.

DuFour, R. (2011). Work together but only if you want to. *Phi Delta Kappan*, 92(5), 57-61.

Eggen, P. & Kauchak, D. (2004). Educational psychology: *Windows on classrooms*. Columbus, OH: Pearson.

Hattie, J. (2009). Visible learning: *A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.