

C&I 489.01 PROBLEM BASED LEARNING CURRICULUM DEVELOPMENT

3 semester hours of credit,

Prerequisites: Bachelors degree and teacher certification

Department of Curriculum and Instruction, College of Education

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Course Description and Aims

Middle school and secondary teachers will develop a better understanding of mathematics and science as they relate to the real world and their curriculum. Mathematics and science teachers will partner with transportation, distribution and logistics teachers and appropriate businesses in their home area to develop problem based learning (PBL) opportunities for their students. As a result of these partnership activities, the teachers will be able to create hands-on, real-world learning opportunities while increasing both student and teacher content knowledge in science and mathematics. Teachers will also be introduced to action research activities to be completed with their students and will develop an action research plan for implementation in their classes.

Student Goals/Objectives

1. Increase mathematics and science content knowledge with special emphasis on:
 - a. Making connections within and among the various branches of mathematics and other disciplines
 - b. Demonstrating, applying and explaining a knowledge and sense of numbers
 - c. Demonstrating, applying and explaining a knowledge and sense of algebra via patterns, functions, symbols and models
 - d. Demonstrating and applying geometrics: methods to analyze, categorize and draw conclusions about points, lines, planes and space
 - e. Understanding concepts, principles and processes of technological design
 - f. Understanding nature and properties of energy
 - g. Understanding and applying the concepts that describe force and motion.
2. Increase mathematics and science teaching skills through access to the expertise of mathematicians, scientists, engineers and other such professionals and their technologies.
3. Demonstrate understanding of the body of knowledge common to problem based learning (PBL) and the development of PBL opportunities for middle and high school students.
4. Increase the understanding and application of educational research pertinent to mathematics teaching and learning.
5. Demonstrate understanding of the body of knowledge related to classroom action research activities.
6. Understand and apply pertinent scientifically based educational research to practice.
7. Demonstrate knowledge of the support, resources, knowledge and skills to align classroom-level assessment and instruction with the Illinois Learning Standards.

8. Demonstrate increased knowledge of the transportation, distribution and logistics career connections with mathematics and science course content through inclusion in current curriculum.
9. Develop connections between mathematics and science instructors; transportation, distribution and logistics instructors; and business representatives.

Topical Outline and Approximate Time Allocations

Session 1 – 6 hours

Complete a comprehensive assessment of teacher quality and professional development needs regarding teaching and learning of mathematics and science

- Receive an overview of problem based learning including the research supporting the use of problem based scenarios
- Develop an understanding of the steps of “scientific inquiry”
- Participate in Action Research training

Session 2 – 5 days - 30 hours

- Complete content training in creating problem based scenarios and associated pedagogy
- Complete a transportation, distribution and logistics mathematics/science content pre-test
- Strengthen conceptual understandings in mathematics, science and engineering as they relate to the transportation, distribution and logistics industry
- Gain an awareness of real world applications of mathematics and science within the transportation, distribution and logistics industry
- Spend two days working with content mentor to apply mathematics, science and engineering content to real world problems that can be incorporated into the PBL
- Select a real-world business problem to be solved
- Begin preliminary work on the PBL curriculum unit
- Present problem solutions to entire group
- Complete the transportation, distribution and logistics content mathematics/science post-test
- Investigate potential transportation, distribution and logistics businesses in the home community with which to work

Session 3 – 7 hours

- Select industry problem on which to develop PBL scenario
- Work in teams to develop begin Problem Based Learning Scenario development

Begin Action Research planning - two days prior to next session – 12 hours,

- PBL development by the teacher team, content mentor and local business representative(s)
- Align PBL to State or district mathematics/science standards

Session 4 – 7 hours

- Present PBL to other teacher/mentor teams, receive critique and revise as needed
- Prepare for school year implementation of the PBL and action research plan

Follow up work – 6 hours

- Work with content mentor to implement the PBL Unit at the home school

Follow up work – 18 hours (3 days)

- Work with teachers/mentors to check on progress in the application of the PBL. Virtual meeting software will be used to conduct these meetings.

Participate in Conference – 14 hours

- Attend a two-day professional development seminar which focuses on integration of academic coursework with CTE curriculum
- Participate in a presentation on PBL development and implementation

Final Session – 7 hours

- Final follow-up meeting
- Deliver summative presentation of curriculum development and integration work
- Complete a post-assessment of teacher quality
- Discuss implementation successes

Student Products and Outcomes, required

Each student is expected to:

- Complete a comprehensive pre- and post-assessment of teacher quality and professional development needs
- Complete the transportation, distribution and logistics mathematics/science content pre- and post-test
- Develop a fully researched and implemented problem based curriculum unit
- Develop an action research plan to determine the success of the unit
- Plan and deliver a presentation on the problem based curriculum unit for other teacher/mentor teams
- Attend a two-day professional development seminar which focuses on integration of academic coursework with CTE curriculum
- Participate in a presentation on PBL development and implementation at a professional development seminar

Student Evaluation

Students are expected to attend each session, read assigned materials, participate in session activities and complete the other requirements as may be necessary.

Grades are based on the following:

Problem based curriculum unit	25%
Action research plan and results report	25%
Presentation on the problem based curriculum unit	25%
Portfolio	25%
TOTAL	100%

Grade Formula

92 – 100% = A

84 – 91% = B

75 – 83% = C

0 – 74 % = F

Text and Resources, required

- The World is Flat, Thomas L. Friedman
- How to Think like Leonardo da Vinci, Michael J. Gelb
- Improving Student Learning, National Research Council
- How to Teach So Students Remember,
- National Career Cluster Standards
- Illinois Learning Standards

Resources, Recommended

- James Stone (2005), National Research Center for Career and Technical Education at the University of Minnesota, Enhancing Instruction with Mathematics. <http://www.nccte.org/publications/projectReports.asp>
- Problems based learning: Center for Problem-Based Learning. Illinois Mathematics and Science Academy (<http://www2.imsa.edu/programs/pbln/>)
- Woods, Donald R. Problem-Based Learning: Helping Your Students Gain the Most from PBL. (1996). McMaster University, Hamilton, Ontario, CA. <http://chemeng.mcmaster.ca/pbl/pbl.htm>; and Problem-Based Learning. University of Delaware. (<http://www.udel.edu/pbl/>)
- Southern Regional Education Board High Schools That Work research (<http://www.sreb.org/programs/hstw/background/backgroundindex.asp>)
- Willard Daggett, "Instructional Strategies: How to Teach for Rigor and Relevance"
- The National Research Council report 2000 publication titled, "How People Learn"
- Stevens, National Research Center on Education in the Inner Cities (Eric Document 419861)
- National Center for Research in Career and Technical Education archived presentations from national experts