

Eight Steps for Embedding Mathematics in the CT Classroom

DESIGN TEMPLATE FOR ANCHOR PROJECT UNITS: EIGHT STEPS

The eight-step process to be used by the interdisciplinary teams is adapted from the framework used in the recently completed study described in *Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE*.¹

The criteria for developing the prototype design template for **Authentic Anchor Project Units** at a minimum will include the following eight-step process.

1. Identify and describe a major project that is rich with embedded mathematics content that career/technical faculty will have students complete during each 12 weeks of school.
2. Identify the embedded mathematics and technical standard(s) and use of technology tools that can be taught through the authentic integrated project units. This will involve taking the mathematics standards and being deliberate about identifying the specific knowledge and skills students are expected to apply and understand.
3. Identify the literacy study skills and habits of success that students will be expected to apply in advancing their mastery of academic and technical content and skills. This will involve the identification of materials to be read; records to be kept; reports to be written; quality of work expected; behavior expectations for individual and for teamwork; and specifications of other key habits of success important to the 21st century workplace, etc.
4. Develop a summative assessment that incorporates mathematics and technical content questions and the use of technology questions at the end of the unit. Describe re-teach strategies for those students who fail to demonstrate mastery and indicate the benchmark level that would be acceptable for demonstrating mastery at the proficient level.
5. Develop a process to pre-assess students' current knowledge and skills as it pertains to mathematics, technical content, technology and tools embedded in the unit. Determine how students will be pre-assessed for current level of knowledge and skills in each of these four domains – mathematics, technical content, the use of technology, and other skills and habits essential to success. Identify the methods and techniques for assessing students' understandings and skills in these areas including questioning, observations, worksheets, group learning activity, vocabulary, etc.
6. Develop how career/technical faculty will engage students with mathematics and technical content and the use of technology and tools embedded in the **Authentic Anchor Project Unit**. This will involve identifying 1) a series of teacher-directed instructional activities; 2) student assignments aimed at helping students understand the mathematics and technical content; and 3) ways technology will be used to enhance learning. Part of this planning will involve bridging the gap between the language of the pathway field as it relates to the language of mathematics. The attempt here is to help students understand the language of the workplace and the formal mathematics language and to see how these are connected without abandoning either. Identify a series of activities that deal with how the students will be introduced to these mathematics and technical concepts and to the technology tools and materials involved in completing this project.
7. Develop how mathematics faculty will engage students with mathematics and technical content and the use of technology and tools embedded in the **Authentic Anchor Project Unit**. Develop related contextual mathematics assignments using the embedded mathematics concept in the unit. This will involve having students to work

¹ Stone, James, Alfeld, C., Pearson, D., Lewis, M.V., and Jensen, S. *Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE*, ST. Paul, MN; National Research Center for Career and Technical Education, July 2006.

through mathematic problems and assignments that are similar to those embedded in the career/technical project. It also involves using examples with varying levels of difficulty going from the basic, proficient to advanced level. This work will continue to bridge the language between academic and the language of the career/technical pathway. Describe how teachers will check for understanding and determine which concepts can be team taught by the mathematics and career/technical teachers.

8. Describe how students will demonstrate their understanding of mathematics and technical knowledge and skills by completing the project as well as completing assignments designed to provide additional practice.

Once the eight steps have been completed, mathematics and career/technical teachers will develop a daily and weekly instructional plan using the SREB/*HSTW* template provided during training to identify what the career/technical and mathematics teachers will do to provide research-based instruction of mathematics in the CT project and in the mathematics classroom through an authentic application of the mathematics of the CT career area.

SREB/HIGH SCHOOLS THAT WORK PROVIDES CONTRACTED SERVICES

GOAL: SREB/*HSTW* proposes to work with interdisciplinary teams of career/technical and mathematics teachers to develop **Anchor Project Units** focused around authentic problems, projects or activities with assignments and learning experiences related to mathematics that will improve the academic and technical achievement of students at the secondary and postsecondary levels. **Anchor Projects are those assignments designed to meet both the technical competencies of the career pathway and the essential academic foundations necessary for secondary and post-secondary college and career success.** Development of **Anchor Project Units** includes: pre-assessing student academic achievement, using instructional strategies in the career/technical classroom that deepen understanding of mathematics; applying instructional strategies and real-world applications from the career/technical classroom to the mathematics classroom to bring relevancy to learning; designing rigorous student assignments in the career/technical and mathematics classes aligned to grade-level academic and industry standards; and develop **Anchor Assessments** to measure student achievement on rigorous mathematics embedded in career/technical pathways in addition to measuring career/technical competencies. The intent is to develop **Anchor Projects Units** that will require students to apply mathematics knowledge and skills most needed to meet AYP mathematics requirements and college and career readiness standards.

FOCUS: The focus will be on designing **Anchor Project Units** in career/technical courses. This effort will seek to develop high-quality **Anchor Project Units** that embed mathematics academic standards to enhance the mathematics learning in career/technical education. Each **Anchor Project Units** will identify the mathematics standards addressed and specify instructional strategies to help students meet these standards. The units will also include a series of instructional lesson plans, student assignments and formative and summative assessments. Further, these project units will be designed to be taught by career/technical and mathematics faculties in a collaborative fashion that will reinforce each other's mathematics and technical instruction and enhance students' learning of mathematics.

SREB/*HSTW/MMGW* will work with interdisciplinary teams to strengthen efforts to improve career/technical studies through **Anchor Project Units** with embedded mathematics standards and assignments that meet the following criteria:

- Represents authentic work that someone employed in an occupation within the pathway would be expected to complete; that would be sufficiently comprehensive and complex to cause students to acquire and apply mathematics and technical knowledge, skills and ways of thinking that will advance their college and career readiness;
- Allows students to plan, correct and evaluate information, analyze situations and develop procedures for solving problems typically encountered in the workplace;
- Is sufficiently comprehensive and complex to allow students to understand, experience and use major technology, tools and materials representative of the pathway;
- Would challenge students intellectually;
- Will allow students to learn from career/technical and academic faculties and experts outside the school; and

- Will allow both individual effort and teamwork.

Anchor Project Unit description and specifications would meet the above criteria. Further, the project description and specifications would contain at a minimum:

- A one or two page succinct description of the project and problems that the students will be expected to complete; and
- A concise explanation of what the project is expected to be — a product, a service to be provided, a process, a research report or a combination of all of these.

Further, the project description and specifications will identify the:

- Mathematics understandings, procedures and reasoning skills that students will be expected to learn, apply and to demonstrate;
- Technical content knowledge and procedure skills students are expected to learn, master and demonstrate; and
- Reading, writing, study skills and other habits of success that students are expected to learn and apply in order to master the related academic and technical content.

DESCRIPTION OF TRAINING: Training for interdisciplinary teams will consist of three two-day training events. At each of the training events, teams will develop an anchor project to be implemented prior to the next training event. After each training event, teams will finalize planning of their anchor project units and implement with students. At the second and third training events, teachers will present their implementation strategies, including a description of their project and the benefits and barriers they needed to overcome before developing the second and third anchor project units. Between each of the training events, follow up coaching visits to school sites will ensure teams are able to successfully complete development and implementation of anchor project units.

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