CASE
Curriculum for Agricultural Science Education

CASE Lesson Development Philosophy

Curriculum for Agricultural Science Education (CASE) courses are developed using elements from pedagogical approaches that are recognized in educational literature as proven and effective modes of teaching and learning. This foundation ensures validity for CASE methodology and provides the recipe for the effectiveness of the CASE model. This paper presents the underlying philosophies that encompass the design elements employed by writers of CASE curricula. The CASE model is a careful blend of time tested instructional strategies used to guide students in their studies to meet the demands of post-secondary education and careers in the Agriculture, Food, and Natural Resources (AFNR) industries.

Building the CASE Foundation

Two primary works are the basis of influence for CASE pedagogy and are used predominately in the overall philosophy of CASE curricula design. *How People Learn* (Bransford, Brown, & Cocking, 2000) defines the audience of learners and epistemological considerations that CASE writers use to reach learners in an effective manner. The second text, *Understanding by Design* (Wiggins & McTighe, 2005) provides the road map used by CASE writers as they design specific lessons of instruction.

How People Learn examines the complexities of human thinking and ultimately provides a standard for designing learning environments. Because students learn in a multitude of ways, clear, discernable outcomes must be used to develop conceptual understandings with learners. Strategies are incorporated to help the learner organize information and properly situate knowledge in contexts that provide meaningful connections for the learner. Specifically, the strategies CASE uses include activities, projects, and problems crafted to address the cognitive, psychomotor, and affective domains of learners. More about activities, projects, and problems will be discussed in subsequent sections of this paper.

The CASE curriculum provides learners very focused and direct concepts set within a relevant context for the learner. This makes learning objectives very clear to students and ensures that previous misconceptions related to the subject matter are corrected and no new misconceptions are fostered. To accomplish this, the lesson design methodology that CASE uses originates from *Understanding by Design*. This writing prescribes a backward design curriculum approach focusing the instruction on specific goals related to the topic of study. The goals represent the knowledge the learner must know about a topic, or depending upon the intent of the goal, the deeper understanding that students must draw from the topic studied. CASE refers to the learning goals as “concepts” that students will know and understand after completing the lesson. The concepts are the intended learning outcomes of the lesson and provide the basis for assessing student performance based on clear and concise goals.

The concepts for CASE curricula are developed from brainstorming sessions involving expert teachers and industry representatives. Once developed and organized into a logical sequence of instruction, the second design element of *Understanding by Design* is implemented. The second stage prescribes the collection of evidence for student assessment. How do the student and teacher know that learning is taking place and that goals are being met? CASE writers determine the criteria that align with each concept. Essential questions are designed to guide students during instruction. These essential questions provide formative assessment that students can use to ensure they are on the right track toward learning the intended knowledge about the topic. Essential questions are crafted in a way to inspire deeper thought about a concept and elevate student thinking about a concept from knowing to understanding. Knowing facts and knowing how those facts fit together to create understanding is one element of learning. However, developing a deeper understanding allows a student to transfer the learning experience to other situations.

In the third and final phase, the scope of the exercises required to meet the demands of the concepts is determined. For CASE, this step begins to identify whether activities, projects, or problems are best suited to reach the learning goals defined by the concepts. At this point, important considerations are made to ratchet up the rigor of the content and instructional strategies used to teach the identified concept. Holding true to the traditions of agricultural education, a blend of knowledge and technical skills is situated within the relevant, real-life context of AFNR subject matter. Students are immersed into learning by doing through rigorous activity-, project-, and problem-based exercises that facilitate instruction related to each concept.

The CASE Mode of Delivery

Too many curriculum “packages” sell the idea of hands-on or inquiry-based learning, but in reality provide reams of didactic lecture that does not promote hands-on learning or inspire inquiry at the very sense of the word. Students must be motivated to become immersed in subject matter, and effective teaching must allow students to learn knowledge and practice skills in realistic settings (Dewey, 1916). Placing the learner in unpredictable, realistic environments elevates not only the relevance for the learner but also the rigor of the learning outcomes.

CASE adopted the Activity-, Project-, and Problem-Based (APPB) Modalities used by Project Lead The Way, Inc. (2006), as the modes of instructional strategies. The APPB Modalities are activity-, project-, and problem-based exercises that challenge the learner to develop specific skill, synthesize and create, and evaluate information to solve complex problems. These are the higher order cognitive skills that post-secondary institutions and industry are demanding from graduates, and are skills that teacher-directed, lecture-based instruction cannot deliver.

The use of APPB Modalities to elevate the learning experiences for students is supported by large body of educational research. However, the direct correlation with the Rigor/Relevance Framework® (Daggett, 2005) provides a clear understanding of how activities, projects, and problems elevate the rigor of student exercises, while at the same time, preserve the relevance to the learner in order to motivate full participation.

Figure 1 depicts an illustration of the Rigor/Relevance Framework® developed by Daggett.

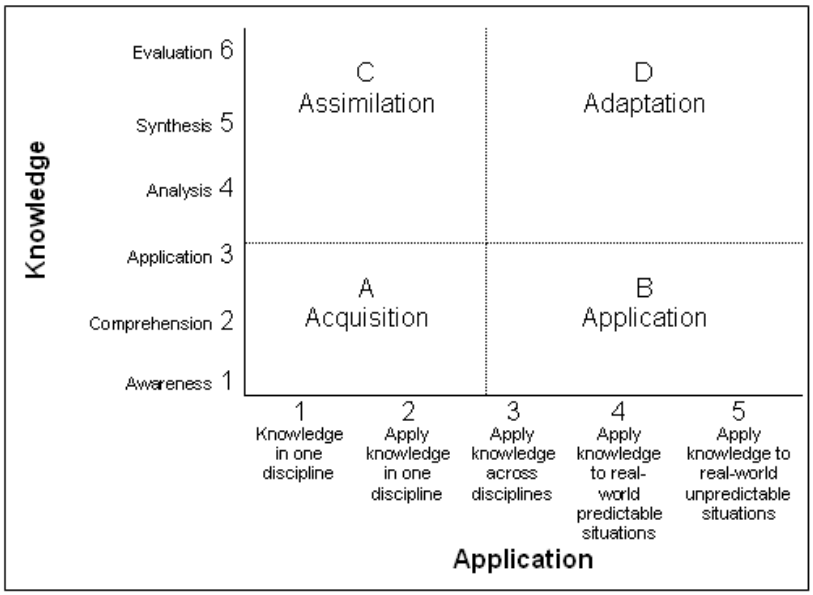

Figure 1. Rigor/Relevance Framework® (Daggett, 2005)

CASE *Activities* fit into the Daggett model shown in Figure 1, at the third level of the Application scale representing "Apply knowledge across disciplines." Activities are designed to promote contextual application of agriculture, food, and natural resources content matter, while enhancing the natural connections with science, mathematics, and English language.

Projects in CASE curriculum align with level four of the Application scale. Projects provide students with learning experiences that teach real world skills and knowledge in a controlled way to ensure that students learn specific outcomes and concepts. Although constraints are provided to students during the course of a project, students are left with ample opportunities to develop creative strategies for completing the project.

According to the Rigor/Relevance Framework® in Figure 1, *Problems* used in CASE lessons apply knowledge to real-world unpredictable situations (level five on Application scale). This level is the most rigorous learning situation a student will endure and provides the richest connections with critical thinking and problem solving. Problems push students into quadrant D "Adaptation" of Figure 1. In this quadrant, students are challenged to answer tough questions as if they were in a real life situation that has multiple outcomes.

CASE employs the activity, project, and problem teaching modalities to promote rigor and relevance in lessons. A well-designed CASE course relies on a delicate combination of each modality to provide the knowledge base, technical skill, and eventually the cognitive reasoning required for solving complicated real life problems. By providing this balance of experiences, students are prepared for challenges of post-secondary education and future careers.

CASE Contributions to Core Academic Subject Matter

CASE provides alignment of lessons with academic standards for AFNR and core-academic subject areas for science, mathematics, and English language. In many situations, core academic standards are used in the development of lesson concepts when natural connections with science, mathematics, or English language elements are present in the context being addressed.

For example, when students conduct an inquiry-based activity involving seed germination, several science standards are incorporated for Unifying Concepts and Processes, Science as Inquiry, and Life Science. Mathematic standards are also addressed as students determine germination percentages and probability estimates. Students must communicate the results of their activity regarding seed germination by creating a written work sample explaining their procedures and findings, thus incorporating English language standards. At the same time, this activity is meeting AFNR content standards for Plant Systems.

Because CASE is a national curriculum for AFNR, national standards are aligned with CASE concepts. In 2009, The National Council for Agricultural Education released National AFNR Career Cluster Content Standards (The National Council for Agricultural Education, 2009). These standards define the student proficiency indicators related to knowledge and skills that students should reach when enrolled in AFNR courses. The AFNR content standards provide the validation of the contextual content for CASE lessons.

National standards for core academics are utilized from three primary sources, including National Science Education Standards (National Research Council, 1996), Principles and Standards for School Mathematics (National Council of Teachers of Mathematics, 2000), and Standards for the English Language Arts (National Council of Teachers of English, 1996). These standards are universal across the nation, and although each state defines its own graduation standards, alignment to national standards can be accomplished rather easily.

CASE strives to ensure that core academics, such as science and mathematics are purposefully and properly taught during instruction rather than just identified in AFNR contexts. After specific lessons are identified that contain natural connections to core academic standards, two very important strategies are used to enhance science or mathematics objectives.

For science related exercises, CASE frames the activity, project, or problem using inquiry-based approaches. Colburn (2004) identified three types of inquiry-based approaches defined by the level of teacher involvement in the facilitation of a laboratory exercise. The three levels Colburn discusses are structured inquiry, guided inquiry, and open inquiry. These levels of inquiry align to the CASE modalities, respectively, with activities using structured inquiry, projects relying on guided inquiry, and open inquiry represented with problem-based learning experiences. Additionally, CASE provides students background knowledge and skills related to the use of science equipment and

procedures necessary to collect evidence and scientifically measure various phenomena.

Recent studies for enhancing mathematics within Career and Technology Education (CTE) contexts, including agricultural education, have been conducted by the National Research Center for Career and Technical Education. A specific study by Stone et. al. (2006) examined the effectiveness of a model that identified a seven-step process to enhance mathematics within CTE context. The Seven Elements of a Mathematics Enhanced Lesson illustrated in Figure 2 was found to be an effective model for enhancing mathematics in a CTE context without sacrificing CTE content in the instructional process. CASE employs the use of the seven-element model when addressing instruction related to mathematics enhancement.

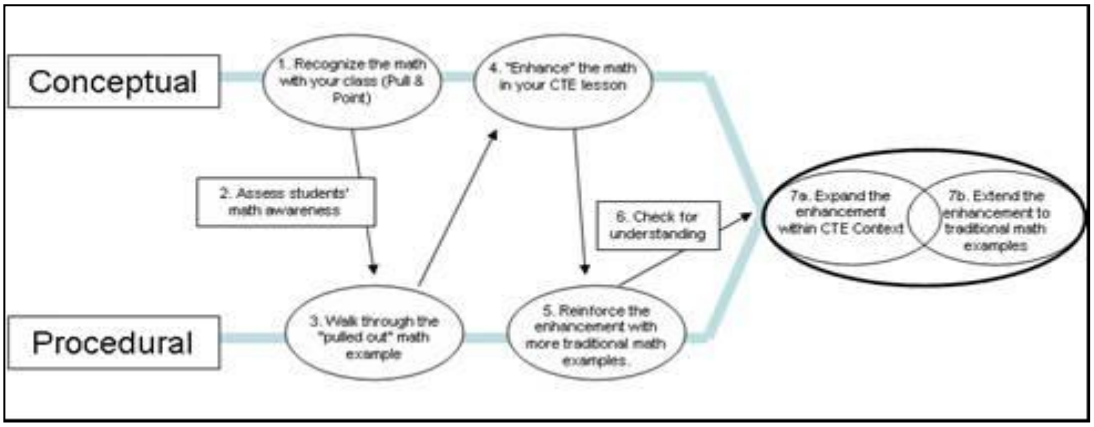

Figure 2. The Seven Elements of a Mathematics Enhanced Lesson (Stone, 2006)

The Three Circles of Agricultural Education

Agricultural education has a proud tradition of providing agriculture students a balanced approach to instruction. The three-circles of agricultural education (Figure 3) emphasize the importance of formal instruction (classroom), leadership and character education (FFA), and experiential learning (SAE). CASE recognizes the value of this proven method and incorporates each element throughout every lesson. Connections are provided as direct ties to the concepts of the lesson with extended opportunities for students to participate in FFA and SAE activities. LifeKnowledge® Connections are also provided as character education components, and the use of E-Moments® delivers effective and creative approaches for formative assessment and reinforcement of concepts.

Figure 3. Agricultural Education Model (Illustration is used with permission from the National FFA Organization, 2008)

Summary

CASE is based on solid instructional design that has been proven to have a positive impact on learners. The approaches presented in *How People Learn* and *Understanding by Design* provide the foundation for this curricula, and the use of activity-, project-, and problem-based instructional strategies facilitate the student-directed learning process. Core-academic standards are enhanced during the instruction of lessons using inquiry-based techniques and the seven-element model for enhancing mathematics. These strategies are situated within agriculture, food, and natural resources contexts to provide rigor and relevance to the learner and prepare students for post-secondary and future careers in the AFNR industry. Careful design considerations are employed by CASE writers to incorporate all three dimensions of the agricultural education model to promote well-rounded experiences in CASE courses.

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