HOME4TECHS
Hands On Maintenance Education 4 TECHnicianS

Faculty Professional Development Day 1 Converting to CB/H Model

Presented by:

Tom Wylie, PI for HOME4TECHS & Scaling CBE Elements
Northwest State CC, Archbold, OH

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Workshop Materials Available for Download:

https://ate.is/Scaling_CBE

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Instructional Elements to Improve Technical Courses

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The Competency-Based/Hybrid Model:

Overview of the CB/H Model: Lecture is moved online, more hands-on learning, performance assessment (one-on-one with faculty), plenty of digital assets (learning objects) used in the LMS.

This Model was used in the Private Sector: The General Mills corporations, based in Minneapolis used a similar model to assess the knowledge and skills of their skilled trades employees starting in the late 1990s. Tom Wylie took DACUM results and created their training manuals, knowledge assessments and skills assessments.

Moodle: Online LMS systems were in their infant stages, and GMI used Moodle for their LMS to house all the instructional materials and record the assessments.

Nocti Testing Services: Knowledge assessments were stored at Nocti so information from all 62 domestic plants could be retrieved by GMI training personnel.

DOA: GMI termed their skills assessment as Demonstration Of Abilities (DOA), and had a Maintenance Team Leader at each plant who tested the maintenance personnel individually.

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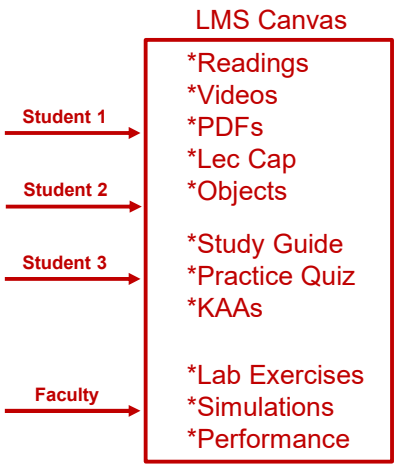
Competency-Based/Hybrid Instructional Model



On-campus class time

Lab Exercises **Hands-On Assessment**

Each Course Consists of 8 Modules

80% Required to Pass LMS Assessment
(Each module has a KAA assessment)

Skills Assessment (4-8 in each course)
***One-on-One with Faculty**
***100% of Tasks Required**
***Must complete to continue in the course**

Couse grade is A, B or F (no Cs & Ds)

Self-proctored Online Assessments

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Why SECC is moving to a new model?

More Hands-On Skills Development: Moving the lecture online makes more time for hands-on learning. Skills Assessment drives students to develop Hands-On Skills.

Faculty assured of Skillset of each Student: One-on-one skills assessment for each student by the Faculty assures the required skills and knowledge. No students can skirt the system.

Student Access: Students have the flexibility of attending any of the scheduled lab times, or scheduled open lab times. Some faculty take attendance in the lab times to identify students' procrastination.

Realignment of Technical Curriculum to meet employer needs: Some of the curriculum had not been changed for 10-20 years. Technology had changed and employers drove us to change.

Adaptive Learners: Employers need to continually update the skills of their workforce. Employees need to be adaptive learners who can learn from multiple methods of delivery (online materials, videos, etc.). Employers do not typically deliver information through a lecture. It simply is not efficient.

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Pedagogy and Learning Styles used in CTE Courses

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Key Evidence-Based Pedagogies

The literature on evidence-based pedagogy is vast, making any summary list inevitably flawed. Moreover, many pedagogies are interrelated and intersect with High-Impact Practices. With those caveats in mind, here is one possible list of major categories of evidence-based pedagogies to consider in developing strategies for advancing student learning and success. For each item listed, we've offered one scholarly source and one more accessible "Getting Started" source (often web based).

Active Learning/Learner Centered Pedagogy: Engaging students in active processes of gathering, considering, applying, and demonstrating knowledge.

- **Getting Started:** *Active Learning.* Resource page created by Cynthia J. Brame, Vanderbilt University Center for Teaching. https://cft.vanderbilt.edu/guides-sub-pages/active-learning
- **Scholarly Source:** *Active Learning: Creating Excitement in the Classroom*, by Charles C. Bonwell & James A. Eison. Published in 1991 by Jossey-Bass.

Holistic Pedagogy: Recognizes the complex interplay between the cognitive and affective dimensions of learning and calls on faculty to address "the whole student."

- **Getting Started:** *Holistic Education: A Comprehensive Guide*, by Becton Loveless. Published in The Education Corner. https://www.educationcorner.com/holistic-education.html
- **Scholarly Source:** Teaching to Promote Holistic Learning and Development. Baxter Magolda, M. B. (2000). *New Directions for Teaching and Learning, 82*, 88-98. https://doi.org/10.1002/tl.8209

Inclusive and Culturally Responsive Pedagogies: Forms of constructivist and active learning that emphasize the social capital and cultural knowledge that diverse students bring to the learning experience and prioritizes the message that everyone can learn and succeed.

- **Getting Started:** *Fostering Inclusion in the Classroom*, by Amy Buddie. https://cetl.kennesaw.edu/fostering-inclusion-classroom
- **Scholarly Source:** *Culturally Responsive Teaching and the Brain: Promoting Authentic Engagement and Rigor Among Culturally and Linguistically Diverse Students*, by Zaretta Hammond. Published in 2015 by Corwin.

Constructivist Pedagogy: Assumes that students bring pre-existing knowledge and attitudes with them. Learning happens as students grapple with new information and experiences, integrating it with prior knowledge in a process that involves taking ownership, interpretation and meaning making.

- **Getting Started:** *Constructivism as a Theory for Teaching and Learning*, by Saul McLeod. Published in 2019 on SimplyPsychology.org. https://www.simplypsychology.org/constructivism.html
- **Scholarly Source:** Evolution of Constructivism. Liu, C. C., & Chen, I. J. (2010). *Contemporary Issues in Education Research, 3* (4), 63-66. https://files.eric.ed.gov/fulltext/EJ1072608.pdf

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This information was referenced from the: Achieving the Dream Teaching and Learning Toolkit

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Inquiry and Problem-Centered Learning: A form of active learning where students engage in structured processes of gathering and analyzing evidence to solve complex, discipline-based and/or "real-life" problems.

- **Getting Started:** *What Is Inquiry Learning? 7 Benefits and Strategies You Need to Know.* https://www.prodigygame.com/blog/inquiry-based-learning-definition-benefits-strategies
- **Scholarly Source:** Science as Subject Matter and as Method, by John Dewey. In R. D. Archambault (Ed.), *John Dewey On Education: Selected Writings* (pp. 182-195). Published in 1964 by University of Chicago Press.

Collaborative Learning: Student active learning processes take place in structured groups with an emphasis on dialogue and carefully constructed shared tasks.

- **Getting Started:** *Collaborative Learning: A Handbook for College Faculty* (2nd ed.), by Elizabeth F. Barkley, Claire Howell Major, & K. Patricia Cross. Published in 2014 by Jossey-Bass.
- **Scholarly Source:** Collaborative Learning: What Is It? Laal, M., & Laal, M. (2012). *Procedia - Social and Behavioral Sciences, 31*, 491-495. https://www.sciencedirect.com/science/article/pii/S1877042811030217

Experiential Learning: A variant of active learning that stresses hands-on experiences, often outside the walls of the classroom. Often used to describe the pedagogy behind service learning, internships, study-abroad, and co-curricular activities.

- **Getting Started:** *Experiential Learning.* Resource page created by University of Texas's Faculty Innovation Center. https://facultyinnovate.utexas.edu/experiential-learning
- **Scholarly Source:** *Experiential Learning: Experience as the Source of Learning and Development* (2nd ed.), by D. A. Kolb. Published in 2014 by Pearson.

Integrative Learning: Seeks to help students make connections across courses and learning experiences, building capacity to transfer and apply learning and developing new identities as students and emerging professionals.

- **Getting Started:** *Integrative Learning,* by Hillary Steiner. https://cetl.kennesaw.edu/integrative-learning
- **Scholarly Source:** *Integrative Learning: Mapping the Terrain,* by Mary Taylor Huber & Pat Hutchings. Published in 2004 by the Association of American Colleges and Universities and the Carnegie Foundation for the Advancement of Teaching. http://gallery.carnegiefoundation.org/ilp/uploads/mapping-terrain.pdf

Writing to Learn: A social pedagogy that posits the act of writing as thinking process and emphasizes scaffolded and low-stakes writing processes to help students build cognitive and communication skills.

- **Getting Started:** *What Is Writing to Learn?* WAC Clearinghouse, Colorado State University. https://wac.colostate.edu/resources/wac/intro/wtl
- **Scholarly Source:** Writing as Learning through the Curriculum. Knoblauch, C. H., & Brannon, L. (1983). *College English, 45*, 465-474.

This information was referenced from the: Achieving the Dream Teaching and Learning Toolkit

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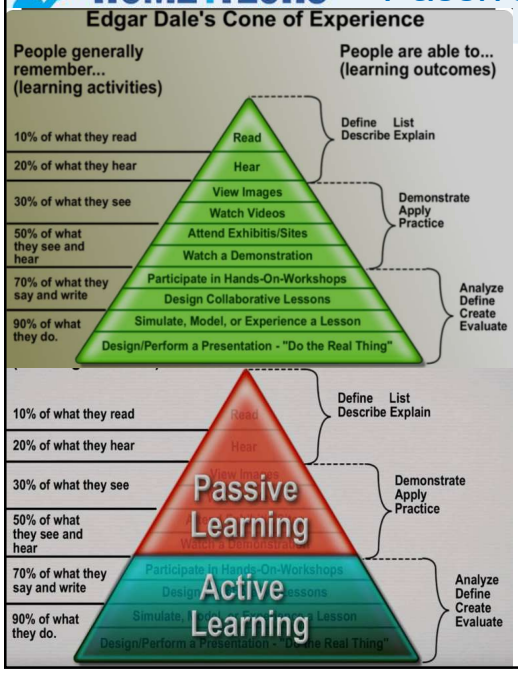
Passive Learning vs. Active Learning



Lecturing and Reading a textbook are both Passive Learning. These are not effective methods of instruction in CTE courses.

Passive Learning is Instructor Centered.

Active Learning is Student Centered. In Active Learning, students will internalize materials such as hands-on, and interactive learning objects: simulations and interactive videos (Questions asked within a video using Canvas Studio).

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Traditional Education Model Versus Competency-Based/Hybrid

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Competency Based Learning:

Competency-based Education (CBE)

The **competency-based education (CBE)** approach allows students to advance based on their ability to master a skill or competency at their own pace regardless of environment. This method is tailored to meet different learning abilities and can lead to more efficient student outcomes. (Educause)

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Competency Based Learning:

Competency-based learning refers to systems of instruction, assessment**,** grading, and academic reporting that are based on students demonstrating that they have learned the knowledge and skills they are expected to learn as they progress through their education.

Some synonyms to CBL include: Proficiency-based, mastery-based, outcome-based, performance-based, and standards-based instruction.

Reference: https://www.edglossary.org/competency-based-learning/

Achieving the Dream movement fully supports CBE, since it is more effective instruction, and offers more access to the under served population.

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What is Competency-based Education (CBE)?

Competency-based Education consists of the following unique elements:

Mastery of Skills - The CBE course is typically parsed into modules, with skills assessments that must be passed at the mastery level.

Flexible Pacing - Student will progress through a course at their pace of learning (and of course mastery). Some students will finish early, and some will take a little longer.

Fixed Learning- Ideally, every student has the same knowledge and skills assessments that require mastery, thus all students should be at the same level when they complete a course.

Variable Time – This refers back to flexible pacing. Student progress through a course at their own pace. Some students finish sooner and can start the next course prior to the start date if they are registered (assessments cannot be open until the start date of the next semester). Some student take a little longer, thus they may need more time than what is in the course (incomplete). Incompletes are awarded by the Dean based on Faculty input. Procrastination is not tolerated.

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CBE is Individualized Learning:

Students decide when and how much to work on the modularized online content. The students are responsible for finishing the online content in a timely manner and must determine when they will take the skills assessments. Faculty will add learning objects to help enhance student learning, and to make the time in the lab environment more efficient.

Videos- Instructors create their own videos on their lab equipment to accelerate student learning. These are screen cams, showing how to use software such as RSLinx and Logix Designer, and also videos explaining how equipment works.

Simulations: Simulation software is used to have students do a similar lab in an online simulated environment, as they will in the hands-on lab.

Hands-On Labs are created to guide the student learning path.

Focused PDF Documents: These are created by faculty to explain something to the students that the textbook does not do. This can be more specific to the equipment in the labs.

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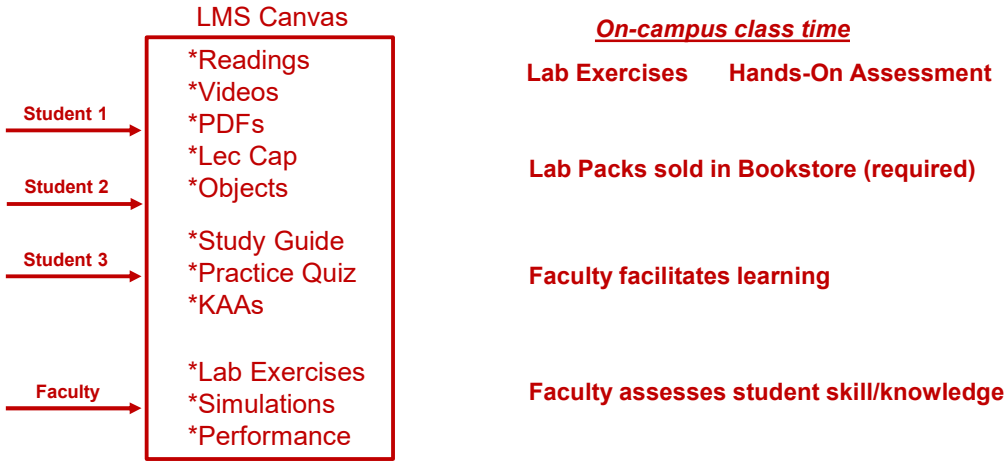
Competency-Based/Hybrid Instructional Model



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Assessment Models:

Traditional Assessment Model:

Test #1
Test #2
Test #3

Knowledge
Paper or
Online
10 Point Sys.
A-F Grade

Competency-based Assessment Model:

M1 KAA
M2 KAA
M3 KAA
M4 KAA
M5 KAA
M6 KAA
M7 KAA
M8 KAA

Knowledge
Paper or
Online
80% min.
A, B, or F

Performance Assessment #1
Performance Assessment #2
Performance Assessment #3
Performance Assessment #4

Skills
Hands-on
100% min.

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Grading in the NSCC Assessment Model:

- The grades the students are awarded in the NSCC Ind. Tech hybrid courses are: A, B or F.
- The hands-on assessment (HOA) must have 100% mastery, so students have to get 100. This is not averaged into the grade. It is required.
- The knowledge & application assessment (KAA for short) is the cognitive, online assessment. Student have to get at least an 80% on this assessment to pass the module. They have two tries at taking KAA in each module.
- 16 assessments in each course (8 online, 8 hands-on)

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Traditional Education vs. Competency-Based

- In a traditional model, the faculty does primarily teaching (Sage on the Stage), and some assessment.
- In a competency-based model, the faculty does primarily assessment, and less teaching than in the traditional model.
- The faculty becomes a learning facilitator, both in the Lab (still teaching the hands-on skills), and also within the LMS (Canvas).

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Lessons Learned And Recommendations

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What's in it for Me? The Stakeholders Perspective

- **Students**: Students like the 24/7 access to the course materials, and knowing what is expected of them for the assessments.
- **Faculty**: Faculty like the consistency in the curriculum, and that all materials are developed, so they do not have to spend time preparing for a class. They also like the flexibility of time on campus.
- **Employers**: Employers like the more accessible classes for their employees, and better prepared graduates. They really like the assessment model of student accountability.
- **College**: Increase in enrollment, increase in retention (SSI), and knowing that the other 3 stakeholders are happy.

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Consistency in Instructional Materials:

Consistency is an important thing to the students at NSCC. Not only are all the documents built in a standard format, but also the LMS course layout is an important standard.

LMS formatting is especially critical. At NSCC, many students did not have great experience taking online courses (primarily Gen Ed), since every Instructor would setup a course differently. The standardization in our LMS was a best practice in our student focus groups.

Learning Objects have a specific format in PPT and Word, with text colors, margins, headers, etc.

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A Few Lessons Learned cont.:

- This model has moved the student learning off the shoulders of the faculty, to the student. Students are responsible for their learning, and when they take their assessments.
- Employers really like this model since all of the curriculum is developed. A positive thing for the companies was if they sponsored students into a course that had two sections with two different instructors, the students get the same learning experience. Reducing the variance.

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A Few Lessons Learned cont.:

- CBE type of technical courses must have a solid structure. How we did technical courses before did not need as much structure.
- Until our Ind. Tech. hybrid courses, online courses were a wild west rodeo. 10 different courses, and they may all look different. Huge negative for the students.
- Our faculty needed to become more literate in the digital world (not just computer literate), due to the moving online, and they needed a support structure.

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Academic Standards

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Instrumentation Technician

9290-FCX Performance, Inc | Toledo, OH 43612

You must create an Indeed account before continuing to the company website to apply

Apply now

Full job description

Essential Functions & Responsibilities:

- Perform field maintenance, installation, troubleshooting, and repair of instrumentation and control systems in a timely, accurate, and safe manner:
  - Calibrate pressure, temperature, flow and various other instrumentation
  - Commission instrumentation and shoot loops
  - Install and Calibrate measuring and positioning devices
  - Perform minor electrical maintenance
- Complete all applicable documentation for actions taken.
  - Report job activity as well as maintain detailed logs about service calls, parts, and orders
- Represent Company during Field Service tasks providing a "can do" attitude
- Identify and report safety issues to proper customer representative
- Identify opportunities for upgrades at the customer facility
- Research task criteria prior to arriving on work site
- Use company vehicle to travel to and from job sites while maintaining

Instrument Technician

Energy Transfer Family of Partnerships | Oregon, OH

You must create an Indeed account before continuing to the company website to apply

Apply now

job duties for this position are listed below:

- Must have ability to carry out assigned preventive maintenance duties and installation assignments of electronic and

control equipment and recommend remedial maintenance as required

- Must have ability to perform periodic and emergency overhauls and reconditioning of equipment including, but not

limited to: remote transmitter units, controller, product identification devices, uninterruptible power supplies, tank alarm, programmable logic controllers, fire detectors, temperature monitors, vibration monitors, line finders, regulated power supplies, frequency to D.C. converters, metering circuits, pressure and temperature transmitters, including totalizers, 24VDC and 120VAC relay logic panels, water well controls, timers and counters, flashpoint detection equipment, vapor detectors, assorted panel meters, electronic tools and test equipment, control valves, instrumentation, control and supervisory equipment.

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Define the Terms used in the Curriculum:

Competencies: Competency is a set of demonstratable characteristics and skills that enable, and improve the efficiency of, performance on a job. Competencies are not skills, but they are similar to skills. A competency is an over arching statement on a job description, which is many times not measurable. Outcomes are measurable, and thus outcomes are used to build a competency.

Knowledge: Knowledge is the theoretical or practical understanding of a subject. It is important to understand that a student cannot develop skills without first having knowledge.

Skills: Skill is the actual performance or demonstration of a technical task. Skills are the proficiencies developed through training or experience.

Abilities: Ability is defined as the capacity to perform. We are preparing the students to have the ability to transfer their learned skills in an industrial setting.

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An example of Competencies & Outcomes:

Competency: Use RSLinx to establish communications between a computer (with PLC programming software) and Allen Bradley PLCs (L5000, SLC-500, PLC-5 & ML1000).

Module Outcomes:
1. Setup communications between a computer and the PLC System (Ports, Cables and Drivers).
2. Identify all the hardware components on a L5571 controller

Skills Assessment:
1. Create an Ethernet driver in RSLinx to communicate with a 1756-ENET module.
2. Create an Ethernet/IP driver in RSLinx to communicate with 1756-ENET module.
3. Create a USB driver in RSLinx to communicate with the controller.

Knowledge Required:
1. What is an IP address? What is a subnet mask? How does an Ethernet port get an IP address?
2. How to determine the IP address of a 1756-ENET module
3. How to use RSWho to view the drivers and communications within a ControlLogix system
4. How to create a driver in RSLinx
5. How to go online to a ControlLogix processor

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Building Measurable Outcomes

- Outcomes must be aligned to a competency, which should align to the workplace
- A Quality Matters alignment table is used to align the outcomes to the competencies
- Outcomes must be measurable
- Students must know what is expected of them. The term "Understanding" is not measurable

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Assessment by Faculty

- Assessment is the responsibility of the faculty.
- Student skills and knowledge are both assessed by the faculty in the Skills Assessment (Knowledge is required, to develop Skills)
- Knowledge is also assessed through an online assessment for each module that faculty developed, which consists of M.C., Matching and T.F. questions. LMS is used to assure students cannot cheat. Use questions the LMS will grade, to make Faculty more efficient.
- LMS efficiency saves faculty valuable time
- The assigned instructor objectively determines if a student passes a module, and the course.
- Create a PLA (Prior Learning Assessment) for the course, based on a combination of the Knowledge and Skills Assessments. This process of testing out of a course has tremendous academic integrity.

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Employer Engagement

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Critical Information from Employers:

- Ask for their skilled Job Classification, and acquire job descriptions (Maintenance Mechanic, Electricians, Instrumentation Tech., Millwright, etc.).
- Find out what technology they use in their plants:
  - *PLC type, HMI type, Robotic type, Connectivity
  - *Instrumentation, Test Equipment, VFD types, etc.
- This will be important information for both the academic division, and also the Workforce Development Group.

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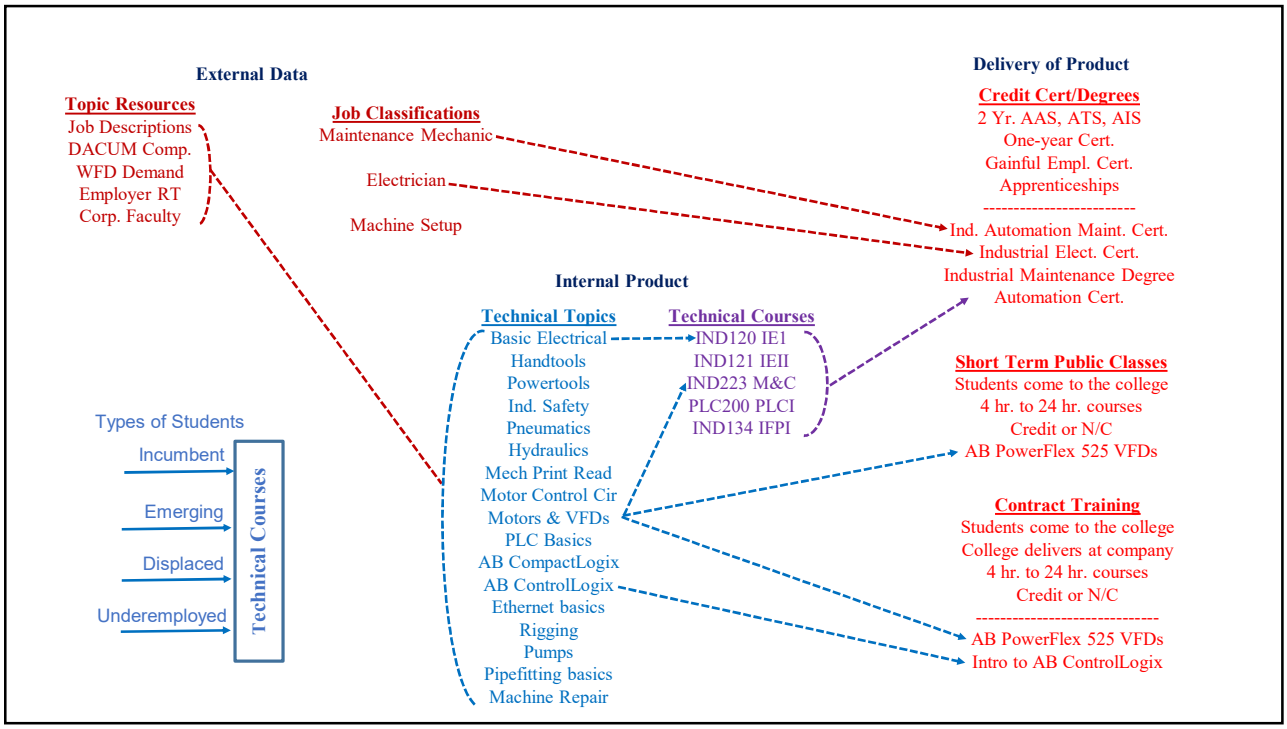

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Show
Electrical Course Sequence
And
Course Overview Sheets

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Getting Input from Employers:

Oversight Group: At some colleges this would be an Advisory Board for a program. The BILT model was implemented at Terra State CC in Ohio. This group is like a steering committee for their technical curriculum.

Technical Topic Roundtables: Our project team found the best way to get input on a topic such as the content of a PLC course, or a fluid power course, is to hold an industry roundtable. This consists of 3-4 SMEs in a 45-minute Zoom meeting. An outline is sent to each 1 week ahead of time, consisting of no more than a 2-page outline of topics that will be reviewed. Input is documented, then sent back out to the small group for their final review. A special focus should be on the hands-on skillset that is required. The nice thing about using Zoom, is the college can do a one-on-one meeting with an SME if they cannot get to the Zoom meeting. Most of all, respect their time and thank them for their input.

Communicate the results of the Roundtable back to the Oversight Group and explain how the curriculum will be adjusted to improve effectiveness and/or access.

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Engaging Employers

- How does the Technology division at SECC engage employers?
- Accrediting bodies like a comprehensive employer engagement strategy
- Purpose of an Advisory Board
- Purpose of an Industry Roundtable
- Purpose of a Focused Industry Visit
- Industry Consortiums (Adv. Mfg. Consortium & Lean Mfg. Consortium)

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Importance of an External SME group

- SME stands for Subject Matter Expert
- 4-6 of these SMEs should be identified to vet information through as part of the development process
- It is important to have all knowledge and skills development, align to the workplace
- This will be done through validated competencies, and measurable outcomes

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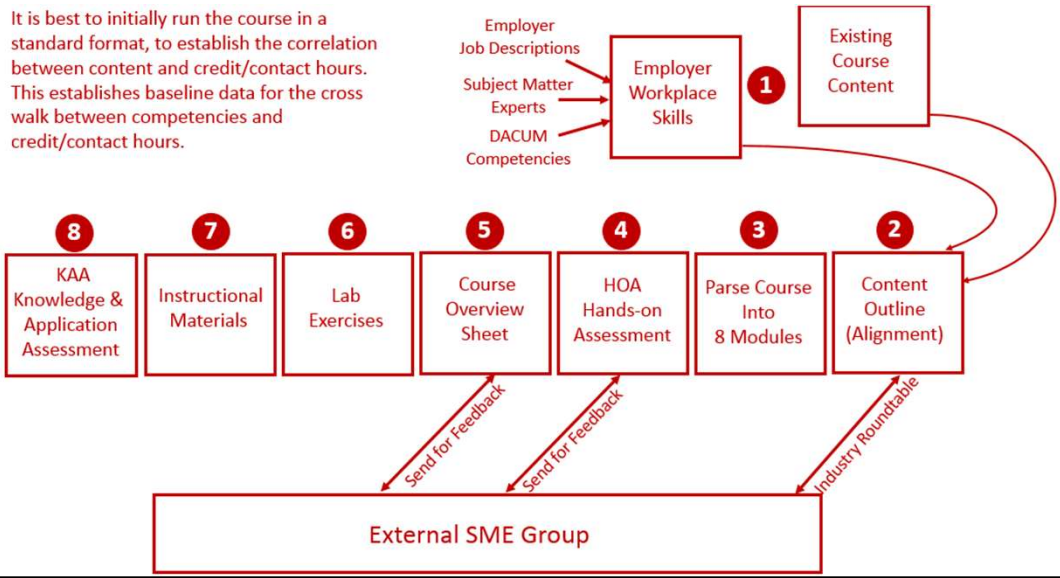
Reverse Design:

It is best to initially run the course in a standard format, to establish the correlation between content and credit/contact hours. This establishes baseline data for the cross walk between competencies and credit/contact hours.



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Creating a Development Process

- **Course Blueprint:** Course Blueprint is a document that will hold all the module information for the course: Module descriptions, module outcomes, topics, skills assessments, etc. The blueprint can be shared with the development team, allowing multiple people to edit the document.
- **IND221 Instrumentation and Controls:** This course at Northwest State CC in Ohio was converted to a CB/H model in Summer/Fall 2023.
- **Review the Development Process**: Electrical Instructor John Mueller was the faculty, we did a course overhaul, with some new lab equipment, and focused on tasks and equipment that is used in the local process industry.

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Learning Thread:

	Course Topics	Design
	Course Outcomes	Design
Hands-On	Performance Assess.	Assessment
	Lab Exercises	Preparation
PPT/PDF Reading Videos	Instructional Mat.	Preparation
	Online Assessment	Assessment
	Practice Quizzes	Preparation

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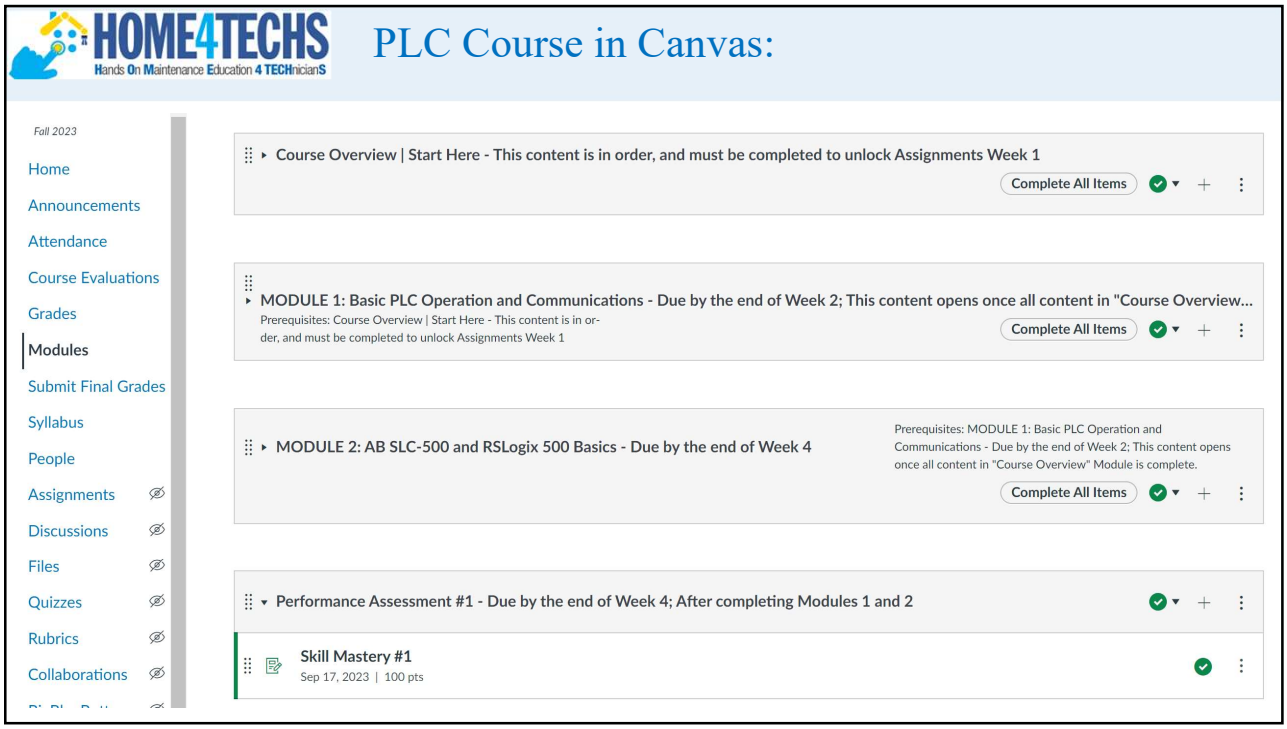
PLC Course in Canvas:



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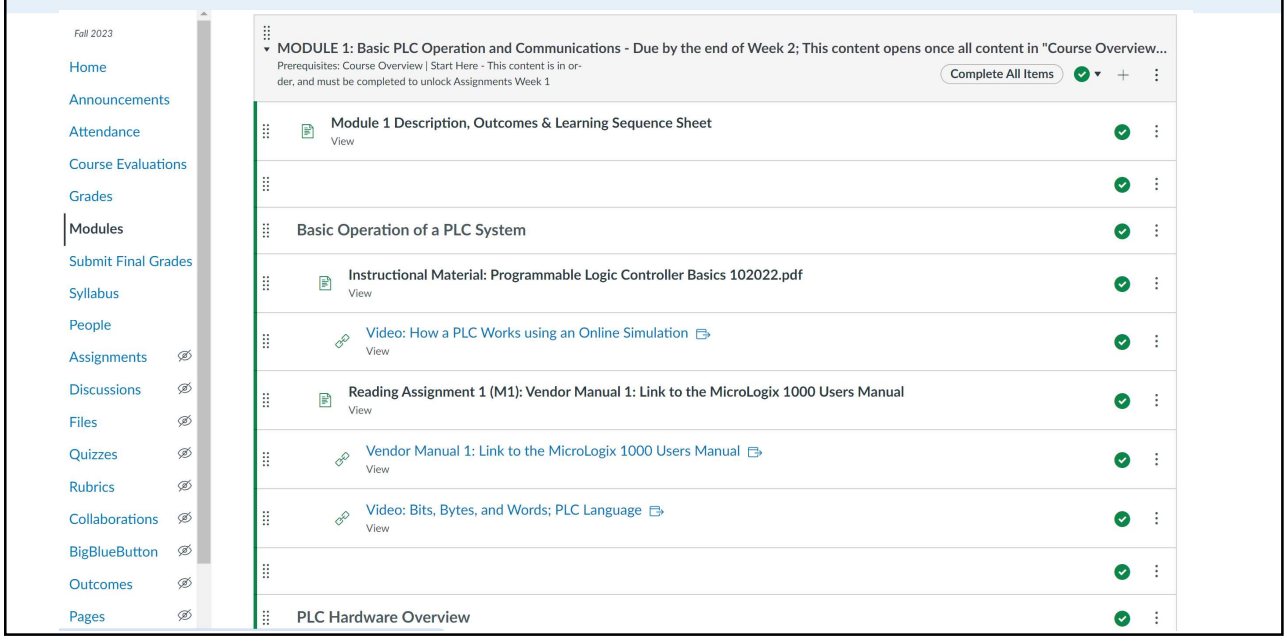
PLC Course in Canvas:



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PLC Course in Canvas (Learning Sequence Sheet):

Course Number and Title:	EET 2440 Programmable Controller I
Module # and Topic Title:	Module #1: Basic PLC Operation and Communications
Semester:	Any – Last updated – 10/31/22

ACTIVITY	DESCRIPTION	TIME ON TASK	POINTS
Reading Activity		Est. TOT **0.0 Hr.**	
Learning Activity	* Instructional Material: Programmable Logic Controller Basics 102022.pdf * Instructional Material: Intro to MicroLogix1000 and SLC-500 Training Units 102422.pdf * Video: Hardware Overview MicroLogix 1000 PLC 102122 * Video: Hardware Overview SLC-500 102222 * Instructional Material: RSLinx and Communications Basics 102522.pdf * Video: Creating an RSLinx RS-232 driver for a MicroLogix 1000 102122 * Video: Creating RSLinx Ethernet Driver for SLC-5/05 102122 * Video: Creating an RSLinx Ethernet IP Driver for SLC-5/05 102122 * Video: Going Online to SLC-500 Multiple RSLinx Drivers and Address Display 102422 * Vendor Manual: Link to RSLinx Classic Getting Results Guide	Est. TOT **12.0 Hr.**	
KAA	KAA Study Guide for Module 1 KAA Practice Quiz for Module 1 KAA for Module 1	Est. TOT **4.0 Hr.**	Min. of 80%
Lab Exercise	Lab Exercise 1.1 ML1000 SLC500 Hardware 102322.pdf	Est. TOT **2.0 Hr.**	
Lab Exercise	Lab Exercise 1.2 RSLinx Communications 102622.pdf	Est. TOT **2.0 Hr.**	
Hands-On Assessment	Hands-On Assessment Preparation	Est. TOT **2.0 Hr.**	Min. of 100%
TOTAL		**Approx.** **24 Hrs**	15-20 hrs. per week

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NSCC Instrumentation & Controls Course:

Converted course to a CB/H model

- Realigned the content to meet employer needs
- Created a course Blueprint to keep track of all information prior to entering into the LMS
- Typically get the Skills Assessment done on the front end of the development cycle
- Labs, PPT, Videos and Knowledge Assessments all built around the Skills Assessment
- Will use examples of each in the training

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How to Get Started?

Choose 1 course to start with such as: Industrial Control Systems

Build Topic List: List out the topics that are in the existing course. Gather topic lists from other ATE projects, or from colleges that will share, then compile into a list to have the industry SMEs review. Try to get a composite list, knowing you will move, add and change topics.

Separate into 8 modules: This could be done before the topic list if it is easier to categorize.

Build the Skills Assessment: At some colleges this would be an Advisory Board for a program. The BILT model was implemented at Terra State CC in Ohio. This group is like a steering committee for their technical curriculum.

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The End of the Presentation

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