

**Pilot Research Study**  
**PLM: The Development of SkillsNet Based**  
**Competency Model for Engineering Education**  
Module 19

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*Teaching Notes in Notes Page View*



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## Overview

- *Change* the only workplace constant
  - Technological innovations
  - Cross-functional teamwork
  - Virtual, sometimes global, teams
  - Implementation of Product Lifecycle Management (PLM)
  - New, results-oriented emphasis in the workplace.
- Need for Reconceptualization
- Competency Model

The workplace is changing. In fact, it's probably safe to say that *change* has become the only workplace constant, especially over the course of the past decade. Examples:

- technological innovations
- cross-functional teamwork
- virtual, global, teams
- results-oriented emphasis in the workplace
- implementation of *PLM*

Workers are being called upon to change because of the changing work environment.

Simple job descriptions are becoming obsolete. What is needed is a reconceptualization of today's worker in terms of his or her *competencies* (clusters of specialized skills, knowledge, and abilities).

Given the increasing use of PLM in industry, is it possible to identify the requisite knowledge, skills, and abilities required of workers in a PLM environment today?

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## Overview (cont.)

- Industry's demand for professionals who are PLM-proficient at time of hire
- Development of a competency model for entry-level engineers in a Product Lifecycle Management (PLM) environment.

Industry is requesting institutions of higher education to be responsive to their PLM needs. The development of a PLM competency model should be able to drive engineering curriculum changes.

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## Product Lifecycle Management

- Focuses on eliminating inefficiency
- Substitutes information for wasted time, energy, and material
- Follows product through entire life-cycle
- Well-known companies beginning to implement PLM

Product Lifecycle Management has garnered interest among corporate decision-makers across the globe.

#### PLM Highlights:

- The major goal of PLM is the elimination of all forms of inefficiency from every phase of manufacturing
- Substitute information for all forms of waste
- Allows the tracking of manufactured goods through the entire product lifecycle
- Examples of companies currently employing PLM include IBM, Airbus, Boeing, Motorola, Toyota, BMW. Many of their supply chain vendors have begun to implement PLM on a broad scale as well.

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## Method

- Tool
  - SkillsNet
- Collaborators
  - 5 PLM Subject Matter Experts
- Task
  - Isolate 30-40 *SkillObjects* for development of Competency Model

### PLM Competency Model Development - Methodology

- Use SkillsNet, a Web-enabled software package, that uses the same language descriptors as, and can therefore interface with, the US Department of Labor's Occupational Informational Network (O\*Net), the repository for job descriptions used by US companies.

- Identify PLM subject matter experts in the field and ask them to complete subject matter expert survey.

- Generate a list of approximately 30-40 SkillObjects based on subject matter experts surveys

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## Method (Cont.)

- Definition of *SkillObject*:
  - detailed description of what people do in order to accomplish work
- Selection of *SkillObject* criteria:
  - In industrial setting
    - ❖ Done by top-tier job incumbent
  - For this project
    - ❖ Assistance of Subject Matter Experts

Definition of SkillObject:

These are detailed descriptions of what people do in order to accomplish work.

Each SkillObject consists of the following elements

- label or name
- tasks
- skills/abilities
- tools/software/equipment/devices
- unique knowledge
- resources, and performance standards.

[For this project, seven highly credentialed Subject Matter Experts from the industrial sector graciously volunteered their services. They are members of Purdue University's Product Lifecycle Management Center of Excellence Advisory Board.]

Subject Matter Experts identify the criteria that will comprise each SkillObject.

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## Method (Cont.)

- The Work Element Editor
  - Eliminate redundancies
  - Clarify all verbiage
  - Check for errors
  - Reduce without losing information
- SkillsNet
  - Compatible with O\*Net
  - Web-enabled

- Upon receipt of a list of SkillObjects, the Work Element Editor carefully examines and edits each SkillObject according to the following guidelines:
  - Eliminate task, tool, and unique knowledge redundancies
  - Clarify tasks, tools, and unique knowledge so that they are understandable to others in the occupation,
  - Fix spelling and grammatical errors, and
  - Reduce the size of a task, tool, and unique knowledge list without losing important information.

In a real-life situation, each list then undergoes several more revisions before its final submission to the managers or supervisors responsible for implementation.

Once again, the software tool, SkillsNet, is ideal to use because it is Web-enabled and because of its compatibility with O\*Net.

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## PLM Competency Model

- Engineering-specific
  - Conform to standards of Society of Manufacturing Engineers
  - Ground-breaking research into “competency gaps”
    - ❖ Defined: Competencies needed by industries but not being adequately taught within academia
- Our project goal: Competency Model
  - SME & PLM compatibility

Sample Competency Model: Mechanical engineering should be generated by subject matter experts and reflect the guidelines that have been specified in the Society of Manufacturing Engineers’ *Manufacturing Education Plan*.

The Society of Manufacturing Engineers, or SME, has effectively been advocating for a competency model for members of its profession since 1997, when it began research into “Competency gaps” – capabilities that companies have been complaining about being lacking among their workers.

One of the significant outcomes from the SME’s research has been the creation of their rank-ordered list of skills that are needed by industry but not being adequately cultivated by academia.

The goal of this module is to suggest a method for creating a competency model that (a) meets the criteria that are specified in the SME’s list and (b) contains the skills, knowledge, and abilities that would qualify an entry-level engineer to function successfully in a PLM environment.

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## Example *SkillObject* Report

- Occupation: Mechanical Engineer
  - Job Family: Architecture and Engineering
  - Economic Sector: Business, Manufacturing
- *SkillObject*: Engineers' Tasks and Enabling Skills and Abilities
  - Read and interpret various types of technical documentation
    - ❖ *Primary skill*: Information organization
    - ❖ *Secondary skill*: Critical thinking
    - ❖ *Primary ability*: Information ordering

Example of a SkillObject report for Mechanical Engineer (see above for elements of a SkillObject report)

## ***SkillObject* Example (Cont.)**

- Communicate with others concerning operational procedures and technical information
  - ❖ *Primary skill:* Writing and speaking
  - ❖ *Secondary skill:* Operations analysis
  - ❖ *Primary ability:* Written and oral expression
- Research proposed designs and analyze relevant data
  - ❖ *Primary Skill:* Writing
  - ❖ *Secondary Skill:* Information Organization
  - ❖ *Primary Ability:* Category Flexibility

Example of a SkillObject report for Mechanical Engineer (see above for elements of a SkillObject report)

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## ***Skill Object Example (Cont.)***

- Recommend product modifications in compliance with desired specifications
  - ❖ *Primary skill:* Writing and speaking
  - ❖ *Secondary skill:* Identification of key causes
  - ❖ *Primary ability:* Originality
- Apply engineering principles to products and systems in conformity with requirements
  - ❖ *Primary Skill:* Critical thinking
  - ❖ *Secondary Skill:* Information Organization
  - ❖ *Primary Ability:* Information ordering

Example of a SkillObject report for Mechanical Engineer (see above for elements of a SkillObject report)

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## SkillObject Example (Cont.)

- **Tools/Software/Equipment**
  - Flowmeters/Interferometers
  - CAD Software/Analytical or Scientific Software
- **Unique Knowledge**
  - Practical application of engineering and technology
  - Designs, uses, repair, and maintenance of machines
  - Manufacture and distribution of products
- **Resources**
  - Computers and Electronics
  - Blueprints
  - Manuals

Example of a SkillObject report for Mechanical Engineer (see above for elements of a SkillObject report)

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## Project Deliverable

- Competency Model
  - Based on 30-40 *SkillObjects*
  - Designed for entry-level engineering professionals
  - PLM proficiency at time of hire

To recap, it is important to establish a methodology for generating a PLM Competency Model that drives engineering curriculum changes. New graduates should be schooled in the knowledge, abilities, and behaviors required to work in a PLM environment.

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