



ORANGE BELT
**LEAN
SIX SIGMA**
SKILL SET

LEAN & SIX SIGMA ORANGE BELT SKILL SET

A GUIDELINE FOR TRAINING AND CERTIFICATION

Title: Lean & Six Sigma Orange Belt skill set
A guideline for training and certification

Authors: H.C. Theisens; T. Hesp; D. Harborne

Publisher: Lean Six Sigma Academy
© Copyright LSSA BV, 2021
Enschede

www.lssa.eu
info@lssa.eu

Version 3.2, March 2021

NUR 100

All rights reserved. The LSSA skill set is a public document and can be distributed in its original and complete version. Partly republication or redistribution is prohibited without the prior written consent from LSSA. LSSA shall not be liable for any errors in the content, or for any actions taken in reliance thereon.

The structure of this document is based on the 'Continuous Improvement Maturity Model' - CIMM™. You have the permission to share and distribute this model in its original form by referencing the publisher and author, (LSSA®, Theisens et. al., 2021).

CONTENT

INTRODUCTION	5
THEORETICAL ASSESSMENT CRITERIA.....	6
CONTINUOUS IMPROVEMENT MATURITY MODEL (CIMM).....	7
U1. WORLD CLASS PERFORMANCE.....	8
E1. Continuous Improvement	8
E2. Customer value (VOC & CTQ)	8
U2. Policy development and deployment	9
E1. Policy development	9
E2. Policy deployment	9
U3. Project Management.....	10
E1. Managing a project.....	10
E2. Process Improvement Roadmaps.....	10
U4. Creating a solid foundation	11
E1. Professional Work Environment.....	11
E2. Standardized work.....	11
E3. Quality Management.....	11
U5. LEVEL II – CREATING A CONTINUOUS IMPROVEMENT CULTURE	12
E1. Visual management.....	12
E2. Performance management	12
E3. Basic Quality tools	12
U6. LEVEL III – CREATING STABLE AND EFFICIENT PROCESSES.....	13
DEFINE	13
E1. Process Mapping	13
MEASURE.....	13
E2. Performance metrics	13
E3. Basic statistics.....	14
ANALYZE	14
E4. Value Stream analysis.....	14

IMPROVE	14
E5. Reducing Muda (Waste)	14
E6. Reducing Muri (Overburden)	14
E7. Reducing Mura (Unevenness)	15
E8. Value Stream Improvement	15
CONTROL	15
E9. Process and Quality control	15
E10. Total Productive Maintenance (TPM)	15
U7. LEVEL IV – CREATING CAPABLE PROCESSES	17
MEASURE	17
E1. Statistical techniques	17
E2. Distributions	17
E3. Measurement Systems	17
ANALYZE	18
E4. Hypothesis Testing & Confidence Intervals	18
E5. Tests for means, variances and proportions	18
E6. Correlation and Regression	18
E7. Process Capability and Performance	18
IMPROVE	19
E8. Design of Experiments (DOE)	19
CONTROL	19
E9. Statistical Process Control (SPC)	19
Appendix A – Bloom's Taxonomy for Performance Criteria	20
Appendix B – Practical project assessment criteria	Fout! Bladwijzer niet gedefinieerd.

INTRODUCTION

Within the domain of Lean and Six Sigma individuals can be trained and certified at different levels. The levels are listed in the Table below.

Belt level	Level
Lean Yellow Belt	Awareness
Lean Six Sigma Yellow Belt	Awareness
Lean Six Sigma Orange Belt	Foundation
Lean Green Belt	Practitioner
Lean Six Sigma Green Belt	Practitioner
Lean Black Belt	Expert
Lean Six Sigma Black Belt	Expert
Master Black Belt	Master

Table 1 - Overview of Lean Six Sigma Belt levels

The LSSA - Lean Six Sigma Academy® was established in September 2009 with the objective to develop an international recognized certification scheme for all Lean and Six Sigma Belt levels. For each level the LSSA Exam Board has developed Skill sets with clear criteria for skills and competences. These Skill sets specify which of the overall Lean and Six Sigma techniques are expected to be included within certain Belt level competencies.

The LSSA Orange Belt Skill sets describe the assessment criteria for the theoretical exam. The Orange Belt certification can be achieved independently. There are no pre-requisites for certification and therefore does not require any prior completion of any other Belt. After completion of the Lean Six Sigma Orange Belt you can subscribe for the Lean Six Sigma Green Belt scheme.

Lean Six Sigma training is provided by a global network of 'Accredited Training Organizations' (ATOs). These ATOs provide training programs that are aligned to the LSSA Skill sets. Examination is provided through the LSSA directly or through APM Group Limited. The exams are open to all. Individuals can apply directly or sign up via one of the ATOs. It is recommended that candidates receive training through an ATO to prepare for certification. Check the LSSA website for an overview of ATOs and the actual exam requirements. On the website you will also find information about how you can claim your Digital badge. Then share your Digital badge on LinkedIn and show that you are active as an Orange Belt.



Figure 1 – Digital badge

THEORETICAL ASSESSMENT CRITERIA

The assessment criteria for the theoretical exam are as follows:

- The theoretical exam consists of 50 multiple choice questions.
 - The duration of the exam is 120 minutes.
 - The pass mark for the exams is set at 63% (32 marks or more required to pass).
 - The exam is Open book, where a maximum of 2 books are allowed.
 - A calculator is allowed.
 - You must be able to identify yourself with photographic ID.
 - There is no practical exam (only for Green and Black Belt certification).
-

CONTINUOUS IMPROVEMENT MATURITY MODEL (CIMM)

CIMM summarizes best practices and techniques of different methodologies in one framework, for different stages of maturity. The CIMM framework describes five consecutive stages: Creating a solid foundation, Creating a continuous improvement culture, Creating stable and predictable processes, Creating capable processes and Creating future-proof processes. Within Lean only the first three levels apply. For Six Sigma all five levels apply.

For each instrumental technique in the CIMM framework, it is possible to indicate the associated desired behavior. The CIMM framework identifies a number of behaviors for each improvement technique, which helps determine whether or not the implementation of the technology in question will be a success and results in a lasting impact.

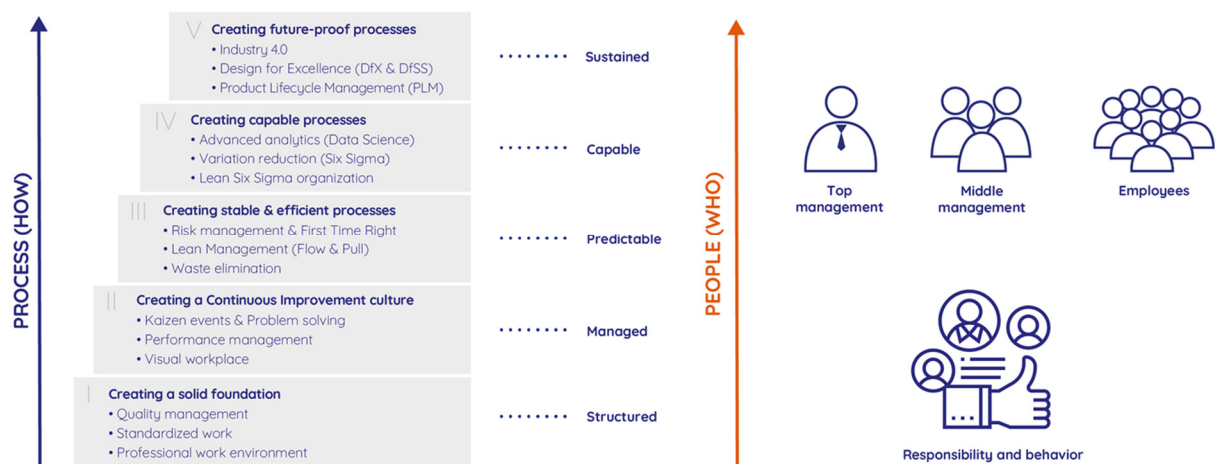


Figure 2 – CIMM Process (HOW) and People (WHO)

The following chapters describe the theoretical skill set elements. The structure consists of a number of 'Units', 'Elements' and 'Performance Criteria'.

- **Unit:** The skill set areas are called 'Unit'. The chapters in the book 'Climbing the Mountain' reflect the 'Units' described in this skill set.
- **Element:** Each 'Unit' consists of a number of 'Elements'. The sections in each chapter of the book 'Climbing the Mountain' reflect the 'Elements' in this skill set.
- **Performance Criteria:** Each 'Element' consists of a number of 'Performance Criteria' and each 'Performance Criteria' has an explanation. These describe the tools, techniques and competencies that are required to be achieved by the Belt. A 'Cognitive Level' has been assigned to each 'Performance Criteria' according to Bloom's Taxonomy [Appendix A].

U1. WORLD CLASS PERFORMANCE

The Unit ‘World Class Performance’ reviews the general philosophy of continuous improvement. It discusses the overview of different process improvement methods and the history of the most important methodologies. It also explains why continuous improvement is important.

E1. CONTINUOUS IMPROVEMENT

The Learning Element ‘Continuous Improvement’ reviews the history, values and principles of the most common process improvement methodologies. Also, the culture within a continuous improvement organization as well as roles and responsibilities are reviewed.

U1.E1.PC1	Continuous Improvement history Recall the origins of quality management, Kaizen, Lean and Six Sigma.	Remember
U1.E1.PC2	Continuous Improvement values and principles Understand that Lean philosophy and principles realize improvements in process lead times and efficiencies.	Understand
U1.E1.PC3	Continuous Improvement Maturity Model Understand the different maturity levels of process management as described in the Continuous Improvement Maturity Model.	Understand
U1.E1.PC4	Continuous Improvement roles and responsibilities Understand the various continuous improvement roles and responsibilities.	Understand

E2. CUSTOMER VALUE (VOC & CTQ)

The Learning Element ‘Customer value’ reviews customer identification (internal/external), customer requirements and the CTQ-measure.

U1.E2.PC1	Voice of the Customer (VOC) Understand the Voice of the Customer (VOC). Understand that different customers have different needs, expectations, requirements and desires.	Understand
U1.E2.PC2	Critical to Quality (CTQ) Understand that Voice of the customer requirements need to be translated into CTQ targets and specifications.	Understand

U2. POLICY DEVELOPMENT AND DEPLOYMENT

The Unit 'Policy development and deployment' reviews how policy development and deployment help organizations in defining a continuous improvement strategy and to run efficiently in achieving their objectives.

E1. POLICY DEVELOPMENT

The Learning Element 'Policy development' explains the importance of a so-called True North and how to develop an operational excellence strategy.

U2.E1.PC1	Vision & True North Understand the meaning and importance of the organization's True North. Understand the meaning of Operational Excellence.	Understand
U2.E1.PC2	Transformation roadmap Understand the meaning of a transition roadmap for implementing continuous improvement.	Understand
U2.E1.PC3	Performance and financial metrics Understand the cost of poor quality (COPQ) metric.	Understand

E2. POLICY DEPLOYMENT

The Learning Element 'Policy deployment' is focusing on the execution process of the improvement strategy. Within this element financial and performance metrics will be reviewed.

U2.E2.PC1	Management of change Recall that an organization's culture can influence the success of Lean Six Sigma deployment.	Remember
------------------	--	-----------------

U3. PROJECT MANAGEMENT

The Unit ‘Project Management’ outlines the way improvement projects should be executed. A number of process improvement roadmaps is reviewed. The Unit also reviews project selection.

E1. MANAGING A PROJECT

The Learning Element ‘Managing a project’ reviews how to set up, plan and execute a project.

U3.E1.PC1	Project selection Understand the process of project selection.	Understand
U3.E1.PC2	Project charter Prepare a problem statement in relation to customer requirements or complaints.	Apply

E2. PROCESS IMPROVEMENT ROADMAPS

The Learning Element ‘Process Improvement Roadmaps’ reviews a number of roadmaps, including PDCA and DMAIC.

U3.E2.PC1	Kaizen roadmap (PDCA) Understand project management methods that are used at the shop floor for Kaizen initiatives (e.g. PDCA, A3-report).	Understand
U3.E2.PC2	Lean Six Sigma Roadmap (DMAIC) Understand and follow the DMAIC roadmap.	Understand
U3.E2.PC3	Problem Solving Process (8D) Understand and be familiar with the problem-solving process (e.g. 8D approach).	Understand

U4. CREATING A SOLID FOUNDATION

The Unit 'Creating a solid foundation' reviews how to achieve a solid foundation for further process improvement programs. This foundation consists of a proper and organized work environment and standardized work.

E1. PROFESSIONAL WORK ENVIRONMENT

The Learning Element 'Professional work environment' is about good housekeeping and how to set up a proper and safe work environment in a structured manner.

- | | | |
|------------------|---|--------------|
| U4.E1.PC1 | Organized work environment (5S) | Apply |
| | Organize the work environment by applying 5S (Sort, Straighten, Shine, Standardize, Sustain). Understand that an organized environment will improve safety and moral. | |

E2. STANDARDIZED WORK

The Learning Element 'Standardized work' is about implementing and improving standards and protocols.

- | | | |
|------------------|---|-------------------|
| U4.E2.PC1 | Standard Work | Understand |
| | Understand that standardized tasks are the foundation for continuous improvement. Interpret standard operating procedures (SOPs) and one-point-lessons. | |
| U4.E2.PC2 | Training Within Industry | Understand |
| | Understand the basic principles of Training Within Industry. | |

E3. QUALITY MANAGEMENT

The Learning Element 'Quality Management' is about developing procedures to identify and detect defects. Also preventing mistakes and avoiding problems are part of this element.

- | | | |
|------------------|--|-------------------|
| U4.E3.PC1 | Quality Management System | Understand |
| | Understand the basic principles of Training Within Industry. | |

U5. LEVEL II – CREATING A CONTINUOUS IMPROVEMENT CULTURE

The Unit ‘Creating a continuous improvement culture’ reviews how to create a continuous improvement culture at the shop floor. This Unit reviews setting up Kaizen teams. It also reviews a number of problem-solving techniques and tools.

E1. VISUAL MANAGEMENT

The Learning Element ‘Visual management’ reviews how to set up a workplace that is organized and self-explaining.

- U5.E1.PC1

Visual workplace

Apply elements of Visual Workplace and understand how these can help to control the improved process.

Apply

E2. PERFORMANCE MANAGEMENT

The Learning Element ‘Performance management’ reviews how to set targets, and how to organize the work to be done. The Learning Element also reviews how to facilitate improvement teams at the shopfloor that work on Kaizen improvement initiatives and Problem Solving.

- U5.E2.PC1

Daily stand-up meetings

Participate in stand-up meetings and Scrum sessions.

Apply
- U5.E2.PC2

Kaizen events and problem solving

Describe and understand the importance of the Kaizen principles. Participate in Kaizen events and continuous improvement initiatives. Apply root cause analysis and understand the issues involved in identifying a root cause.

Apply

E3. BASIC QUALITY TOOLS

The Learning Element ‘Basic quality tools’ reviews techniques to visualize data and guidelines how to facilitate and participate in brainstorm sessions.

- U5.E3.PC1

Brainstorm techniques

Apply brainstorm techniques: affinity diagram, 5-Why's and Ishikawa.

Apply
- U5.E3.PC2

Visualization of data

Apply basic quality tools to visualize data: Scatter plot, Pareto chart, Bar chart, Pie chart, Time Series Plot, Histogram and Box plot.

Apply

U6. LEVEL III – CREATING STABLE AND EFFICIENT PROCESSES

The Unit 'Creating stable and efficient processes' reviews how the logistical flow of processes can be improved and made more stable, predictable and efficient. This Unit reviews tools which can be used to visualize and analyze the process flow as well as a number of tools and techniques that can be used to improve efficiency, effectiveness, productivity and agility of processes. All Level III Learning Elements and Performance Criteria follow the DMAIC structure.

DEFINE

E1. PROCESS MAPPING

The Learning Element 'Process Mapping' reviews a number of tools to map and analyze the flow of a process.

U6.E1.PC1	High-level process description Participate by identifying input and output process variables and be familiar with SIPOC technique.	Understand
U6.E1.PC2	Process Flow diagram Participate in process mapping initiatives to visualize the flow of activities and decisions within a process.	Understand

MEASURE

E2. PERFORMANCE METRICS

The Learning Element 'Performance metrics' reviews performance metrics for both logistics as for quality.

U6.E2.PC1	Performance metrics (Time) Understand performance metrics related to time (e.g. takt time, cycle time, lead time, queue time, WIP, yield and OEE). Understand Little's law.	Understand
U6.E2.PC2	Performance metrics (Quality) Understand performance metrics related to quality (e.g. PPM, DPMO, DPU and RTY). Understand the difference between a defect and a defective.	Understand

E3. BASIC STATISTICS

The Learning Element ‘Basic statistics’ reviews different types of data, measurement scales and data collection tools. Also a set of measures (statistics) that characterizes a given set of data are reviewed.

- U6.E3.PC1

Data types and Measurement scales
Understand the difference between quantitative and qualitative data. Understand the difference between continuous (variables) and discrete (attributes) data.

Understand
- U6.E3.PC2

Data collection tools
Apply tools for collecting data such as data sheets and check sheets.

Apply
- U6.E3.PC3

Descriptive statistics
Understand the basic terms of statistics e.g. proportion, mean, standard deviation and range.

Understand

ANALYZE

E4. VALUE STREAM ANALYSIS

The Learning Element ‘Value Stream Analysis’ reviews how to create a Value Stream Map of the current situation.

- U6.E4.PC1

Value adding versus Non-value adding
Understand the difference between value adding and non-value adding activities.

Understand
- U6.E4.PC2

Value Stream Mapping (Current State)
Understand that Value Stream Mapping is a technique for identifying waste and non-value adding activities.

Understand

IMPROVE

E5. REDUCING MUDA (WASTE)

The Learning Element ‘Reducing Muda’ reviews how to identify and eliminate Waste in the organization and its processes.

- U6.E5.PC1

Waste identification
Identify and eliminate process Waste (Muda): Overproduction, Waiting, Transport, Overprocessing, Inventory, Movement, Defects and Unused expertise.

Apply

E6. REDUCING MURI (OVERBURDEN)

The Learning Element ‘Reducing Muri’ reviews how to identify overburden in the organization. This element also reviews how to implement flow and work balancing to reduce overburden.

- U6.E6.PC1

Flow
Understand the meaning of Flow.

Understand
- U6.E6.PC2

Work balancing
Understand the meaning of Work balancing.

Understand

E7. REDUCING MURA (UNEVENNESS)

The Learning Element 'Reducing Mura' reviews how to identify unevenness in the organization and its processes. This element also reviews a number of techniques to reduce unevenness.

U6.E7.PC1	Pull Understand the meaning of Pull.	Understand
U6.E7.PC2	Volume and Type leveling Understand basic principles of volume leveling, type leveling and one piece flow.	Understand

E8. VALUE STREAM IMPROVEMENT

The Learning Element 'Value Stream Improvement' reviews how the techniques and tools that reduce Muda, Muri and Mura can be applied in constructing a Future State Value Stream Map.

U6.E8.PC1	Value Stream Mapping (Future State) Understand the difference between current state and future state Value Stream Mapping.	Understand
------------------	--	-------------------

CONTROL

E9. PROCESS AND QUALITY CONTROL

The Learning Element 'Process and Quality control' looks at how results that have been achieved in process improvement projects can be sustained. This element reviews the following techniques and principles: Process FMEA, Control plan, Jidoka and Poka Yoke.

U6.E9.PC1	First Time Right (FTR) Understand the importance of First Time Right principles. Understand the work has to be stopped when there is a quality problem (Jidoka). Identify opportunities to apply Poka Yoke to avoid quality problems.	Understand
U6.E9.PC2	Process FMEA (pFMEA) Understand the purpose and elements of Process FMEA, including the risk priority number (RPN) and describe FMEA results for processes.	Understand
U6.E9.PC3	Control plan Participate in developing a control plan to document and hold gains and assist in implementing controls and monitoring systems.	Understand

E10. TOTAL PRODUCTIVE MAINTENANCE (TPM)

The Learning Element 'Total Productive Maintenance' reviews the coherence between reliable systems and equipment and continuous improvement.

U6.E10.PC1	TPM principles Understand the eight pillars of TPM and understand how it can be used within process improvement.	Understand
-------------------	--	-------------------

SIX SIGMA ORANGE BELT SKILL SET

A GUIDELINE FOR
TRAINING AND CERTIFICATION

U7. LEVEL IV – CREATING CAPABLE PROCESSES

The Unit 'Creating Capable Processes' focuses on reducing variation in a stable process with the objective to create a process capable of meeting customer requirements. This Unit reviews the application of Six Sigma and statistical tools used to assure a valid and reliable performance measurement system, to collect data and to analyze the performance of processes. Six Sigma focuses on quality breakthrough improvement projects. All Level IV Learning Elements and Performance Criteria follow the DMAIC structure.

MEASURE

E1. STATISTICAL TECHNIQUES

The Learning Element 'Statistical techniques' reviews a number of metrics that are often used in Six Sigma projects. The element also reviews a number of sampling methods for assuring data accuracy and integrity.

U7.E1.PC1	Variation Understand the difference between special cause and common cause variation.	Understand
U7.E1.PC2	Sampling Understand it is important to follow systematic data collection. Understand the basic terms of statistics e.g. mean and spread.	Understand

E2. DISTRIBUTIONS

The Learning Element 'Distributions' reviews a number of continuous and discrete distributions. The element also reviews the central limit theorem and a number of probability concepts.

U7.E2.PC1	Continuous distributions Understand and interpret Normal distribution.	Understand
------------------	--	-------------------

E3. MEASUREMENT SYSTEMS

The Learning Element 'Measurement Systems' reviews how to evaluate measurement systems.

U7.E3.PC1	Measurement systems analysis Understand the basic principles of performing a Measurement System analysis. Understand the difference between repeatability and reproducibility (R&R) and the meaning of the number of distinct categories.	Understand
------------------	---	-------------------

ANALYZE

E4. HYPOTHESIS TESTING & CONFIDENCE INTERVALS

The Learning Element ‘Tests for means, variances and proportions’ reviews the basic principles of hypothesis testing.

U7.E4.PC1	Hypothesis testing Under the basic principles of hypothesis testing.	Understand
U7.E4.PC2	Confidence intervals Understand the basic principles of confidence intervals.	Understand

E5. TESTS FOR MEANS, VARIANCES AND PROPORTIONS

The Learning Element ‘Tests for means, variances and proportions’ reviews the most common hypothesis tests to investigate the difference between population means (μ).

U7.E5.PC1	Tests for means Understand the basic principles of tests for means.	Understand
------------------	---	-------------------

E6. CORRELATION AND REGRESSION

The Learning Element ‘Correlation and Regression’ describes the predictive models using regression techniques to determine the relation between factors on a response.

U7.E6.PC1	Correlation coefficient Interpret the correlation coefficient.	Understand
U7.E6.PC2	Regression analysis Apply linear regression to understand the relationship between factors and response.	Apply

E7. PROCESS CAPABILITY AND PERFORMANCE

The Learning Element ‘Process Capability and Performance’ explains process capability and performance in relation to specification limits.

U7.E7.PC1	Process Capability (Cpk) Understand basic principles of process capability studies. Understand the importance of stability in process capability studies.	Understand
U7.E7.PC2	Short-term and long-term capability Understand the difference between long-term and short-term capability.	Understand

IMPROVE

E8. DESIGN OF EXPERIMENTS (DOE)

The Learning Element 'Design of Experiments' reviews efficient ways of experimenting. Design of Experiments examines the influence of factors and interactions on a process.

U7.E8.PC1	Principles and terminology	Understand
	Understand the importance of efficient ways of experimenting.	

CONTROL

E9. STATISTICAL PROCESS CONTROL (SPC)

The Learning Element 'Statistical Process Control' explains the controls methods used to identify out-of-control situations and deviations over time. Different types of SPC charts are reviewed.

U7.E9.PC1	Control charts	Understand
	Understand the usefulness of control charts such as Xbar-R.	

APPENDIX A – BLOOM'S TAXONOMY FOR PERFORMANCE CRITERIA

In addition to specifying content, each performance criteria in this skill set also indicates the intended complexity level of the test questions for each topic. These levels are based on 'Levels of Cognition' (from Bloom's Taxonomy – Revised, 2001), and can be used to create learning outcomes for students.

The Taxonomy of Educational Objectives, often called Bloom's Taxonomy, is a classification of the different objectives that educators set for students (learning objectives). The taxonomy was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago. During the nineties, Lorin Anderson a former student of Bloom revisited the cognitive domain in the learning taxonomy. Bloom's Taxonomy divides educational objectives into three 'domains': Affective, Psychomotor and Cognitive. This Skill set only notices the Cognitive domain. The 'Levels of Cognition' are in rank order - from least complex to most complex. The Orange Belt skill set mainly focuses on the levels 'Remember', 'Understand' and 'Apply'.

Remember

Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc. The LSSA uses the following verb at this level: Recall.

Understand

Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc. The LSSA uses the following verbs at this level: Describe, Follow, Identify, Interpret, Participate, Understand.

Apply

Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc. The LSSA uses the following verbs at this level: Apply, Assess, Assure, Calculate, Convert, Define, Demonstrate, Divide, Eliminate, Empower, Facilitate, Implement, Motivate, Organize, Plan, Prepare, Present, Promote, Propagate, Review, Select, Standardize, Support, Use.

Analyze

Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario. The LSSA uses the following verbs at this level: Analyze, Construct, Deploy, Design, Develop, Distinguish, Evaluate, Lead, Manage, Translate.

Evaluate

Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards. The LSSA does not use this level in their skill sets.

Create

Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn. The LSSA does not use this level in their skill sets.
