

## Chapter 4 Lesson Instruction Skills

### 4.1 Roles of Lessons

A lesson is a minimum unit which composes a training course. There are training courses for a few years, months, weeks, or days, and each of them is comprised of accumulated lessons. The length of one lesson can be 30 minutes to 3 hours, or even up to half a day.

A training course needs to be planned so that the trainees can achieve the attainment objective set by the training course. Each lesson has a small attainment objective which composes the attainment objective of the entire training course. For example, a slightly larger attainment objective such as “to be capable of assembling machine products” is set in one month “Machine Assembly Course”. A lesson entitled “Bolt Tightening” which is part of the “Machine Assembly Course” sets some small attainment objectives regarding bolt tightening work necessary for assembling machine products, such as “to be capable of tightening bolts without injury” and “to be capable of tightening bolts at specified torques”. (Section 3.4.1 “Setting the training plan (curriculum) for the trainees to achieve their attainment objectives” illustrates the relationships between the training course plan and the lesson plan, taking the Silviculture (Forestry) Course as an example).

Having become capable of “assembling machine products” when trainees completed the above “Machine Assembly Course” means that the attainment objective was achieved. For this to happen, the trainees must have achieved the attainment objectives of the lesson as the minimum unit comprising a training course. In above case of “Bolt Tightening”, the trainees need to have been capable of “tightening bolts without injury” and “tightening bolts at specified torques” when the lesson is over.

On the other hand, a lesson is an activity where the VT instructors conduct training for the trainees while the trainees learn from it. The purpose of lessons is to enhance the trainees’ ability. By enhancing their ability, the trainees can become able to do what they have not been able to do in the past. In other words, the trainees achieve the attainment objective of the lesson. In this wise, lessons serve as an opportunity for the trainees to enhance their ability. Therefore, an instructional program for the VT instructors and learning of the trainees need to be planned so that the trainees are able to enhance their ability to achieve the attainment objective of each lesson included in the training course.

It is easy to find out whether trainings are meaningful. It can be confirmed by conducting a certain evaluation to check whether the trainees achieved the attainment objectives at the end of training. In other words, lessons should be conducted so that all the trainees become capable to pass the evaluation.

## 4.2 Lesson Plans

### 4.2.1 Roles of lesson plans

Lessons will be planned by using the lesson plan format. Table 4-1 is the example of the lesson plan for “how to tighten hexagon bolts”.

In the lesson plan, what is the content of the lesson and how it progresses are described. Ideally, it needs to be described so that everyone who reads this lesson plan can conduct the lesson and guide the trainees to achieve the same attainment objective.

The lesson plan consists of the “Lesson Outline” and the “Lesson Procedure”. The description method of “Lesson Outline” is expounded in “4.2.2 Clarifying the purposes of lessons” and “4.2.3 Clarifying attainment objectives and training items”.

This portion should be described so that everybody who reads through the “Lesson Outline” can understand the outline of the lesson. How actual lessons are proceeded is described in “Lesson procedure”.

**Table 4-1 Example of the Lesson Plan (excerpt)**

Lesson Outline			
Lesson theme	How to tighten hexagon bolts		
Purpose of lesson	<p>There are many situations where bolts are tightened for a variety of purposes, such as assembly of metallic products, assembly of automobiles and machines, mounting of tire wheels, structuring of building structures, and assembling of electrical components to distribution boards. In these situations, failing to tighten bolts in a proper manner by using proper tools might damage bolts, products, and tools. Additionally, bolts could loosen over time in the future. Such a failure worsens work efficiency and increases unnecessary repair work, and will result in causing accidents at a later date. Furthermore, injuries could occur when over tightening bolts strongly or unscrewing them by swinging your arm widely and hit your hand on other parts around you.</p> <p>The purpose of this lesson is in order for workers in a wide variety of trades to acquire bolt tightening skills which they need to know as common skills.</p>		
Attainment objective	1. Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness.		
Training items	<p>1. Work without causing accidents</p> <p>1-1 Types and name of the tools and how to use (open ended spanner, offset wrench, socket wrench, and extension bar)</p> <p>1-2 Work while preventing cause of injuries</p> <p>(a) Accident types (the tools “slipping off” while in use, sudden looseness)</p> <p>(b) Injury preventative measures</p>		
Eligible persons	<p>Workers who tighten bolts for their work</p> <p>Workers who can hold tools, such as socket wrenches, with both hands</p>		
Training hours	3 hrs.	Tools used, etc.	<p>Bolt tightening training materials (See Figure 4-10 ①-⑧)</p> <p>Open ended spanner, 8x9, 10x12, and 12x14</p> <p>Offset wrench, 8x9, 10x12, and 12x14, with 0°, 15°, and 45° for each</p> <p>A set of socket wrenches with 9.5mm square drive, 12.7mm square drive, hexagonal/dodecagonal socket wrenches</p> <p>Indicating torque tools, 10-50N/m and 20-130N/m</p>

4.2 Lesson Plans

Lesson procedure			
Classification	Hrs.	Development	Remarks
Introduction Motivation	5/5	<ul style="list-style-type: none"> <li>Showing the following work, and have the trainees realize that failing to tighten bolts in a proper manner might damage tools or bolts, or could cause injuries.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <p>1st: Tighten a bolt by using a socket wrench in the proper size. Tighten the bolt properly while noticing the following points. Direction where the hand does not hit anything. Hold the socket base (the front part of the wrench handle) and the end part of the handle</p> <ul style="list-style-type: none"> <li>Explain that today's training is about this bolt tightening work.</li> </ul> <p>2nd: Tighten a bolt by using a socket wrench with the long handle until wrenching off the bolt</p> <p>3rd: Using a socket wrench with the short handle, show how the bolt is difficult to be unscrewed, but suddenly becomes loosened</p> </div> <ul style="list-style-type: none"> <li>Motivate the trainees by explaining the purpose as shown below:               <ul style="list-style-type: none"> <li>The trainees will tighten bolts in various places in the future</li> <li>Failing to tighten bolts in a proper manner could damage tools and bolts, or even cause injuries.</li> <li>This might reduce production efficiency, resulting in dampening competitiveness.</li> <li>To learn how to tighten bolts properly</li> </ul> </li> </ul>	
Presentation		<ul style="list-style-type: none"> <li>Explain the objective as follows:               <div style="border: 1px solid black; padding: 5px;"> <ol style="list-style-type: none"> <li>Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness</li> <li>Capable of using tools according to the assigned work</li> <li>Capable of tightening bolts at specified torques</li> <li>Capable of tightening bolts according to each object (washers, workability, and distortion)</li> </ol> </div> </li> <li>Explain how training progresses as follows:               <div style="border: 1px solid black; padding: 5px;"> <ol style="list-style-type: none"> <li>Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness</li> <li>Capable of using tools according to the assigned work</li> <li>Capable of tightening bolts at specified torques</li> <li>Capable of tightening bolts according to each object (washers, workability, and distortion)</li> </ol> </div> </li> </ul>	
"Development" Motivation	20/25	<ul style="list-style-type: none"> <li>1. Work without causing accidents</li> </ul> <p>1-1. Types and names of the tools and how to use (open ended spanner, offset wrench, socket wrench, and extension bar).</p> <ul style="list-style-type: none"> <li>Motivate the trainees by giving the following explanations               <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>If you do not know the name of each tool, you will get confused in the subsequent explanation .</li> <li>The name of tool to be used today and the outline of how they are used will be explained.</li> </ul> </div> </li> </ul>	

<p>Presentation</p>		<ul style="list-style-type: none"> <li>• Explain the name of each tool and each part of the tool along with how to use as described below. However, demonstrate only how to tighten and loosen bolts. How to adjust the wrench handle position is not trained at this stage.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Open ended spanner, its head, and its handle Show how both ends are attached to the nut</li> <li>• Offset wrench, its head, and its handle Show how both ends are attached to the nut</li> <li>• Socket wrench, extension bar, socket, spinner handle, and ratchet handle Combine the spinner handle with the socket and show how to attach them to the nut. Show how to combine the spinner handle with the socket and the extension bar. Show how the rotation direction can be changed by operating the switching lever on the ratchet handle</li> </ul> </div>	
<p>Application</p>		<ul style="list-style-type: none"> <li>• Apply training as follows:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Showing some tools and each part of a tool, have the trainees answer their name.</li> <li>• Align the tools on the table. Say the name of each tool, and have the trainees pick up the one mentioned.</li> </ul> </div>	
<p>Evaluation</p>		<ul style="list-style-type: none"> <li>• Observing their performance, conduct evaluation as follows:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Check whether each of the trainees can say the correct tool name.</li> <li>• Check whether each of the trainees can pick up the correct tool.</li> </ul> </div>	

#### 4.2.2 Clarifying the purposes of lessons

If the purpose of lesson and its attainment objective have already been clarified based on research for training needs, ability analysis, target analysis and job breakdown, these would be transcribe to the lesson plan when you plan a training course.

However, the purpose of setting up a training course which has been clarified by the training needs research is too broad as a purpose of lesson. For this reason, the purpose of lesson needs to be set based on consideration of purpose of setting training course and the attainment objective of each lesson which is refined through ability analysis, target analysis and job breakdown.

The following two information items are written in the purpose of lesson.

- (1) Backgrounds on implementing the lesson
- (2) Capabilities of individuals who can correspond to these backgrounds

With that, the description can be organized as “The purpose of the lesson is to develop human resources who have these capabilities”. For example, the lesson plan presented in section “4.2.1 Roles of lesson plans,” the purpose of lesson is described as shown in Table 4-2.

**Table 4-2 “Purpose of Lesson” as an Example of the Lesson Plan (excerpt)**

Purpose of lesson	Backgrounds
	There are many situations where bolts are tightened for a variety of purposes, such as assembly of metallic products, assembly of automobiles and machines, mounting of tire wheels, structuring of building structures, and assembling of electrical components to distribution boards. In these situations, <u>failing to tighten bolts in a proper manner by using proper tools might damage bolts, products, and tools.</u> Additionally, bolts could <u>loosen</u> over time in the future. Such a failure worsens work efficiency and increases unnecessary repair work, and will result in causing accidents at a later date. Furthermore, injuries could occur when over tightening bolts strongly or unscrewing them by <u>swinging your arm widely and hit your hand on other parts around you.</u>
	In this lesson
	Corresponding ability: For workers in a wide variety of trades to acquire <u>bolt tightening skills which they need to know</u> as common skills is the purpose of lesson.

The purpose of the lesson described here explained that following (1) through (5) are underlined as the backgrounds for implementing this lesson

- (1) There are many workplaces where bolt tightening work is required.
- (2) Bolt tightening could damage bolts and tools.
- (3) Bolts could be loosened.
- (4) Work efficiency could be reduced.
- (5) Injuries could be caused.

The corresponding capabilities are summarized as “Bolt tightening skills which they need to know as common skill”, while the following tightening skills from (1) through (3) are assumed.

- (1) Bolt tightening that leaves no damage to bolts and tools
- (2) Bolt tightening that causes no looseness
- (3) Bolt tightening that prevents causing injuries

Next, the purpose of lesson serves as “motivation” in the lesson given. “Motivation” is activity of the VT instructors to make the trainees want to receive the lessons. The instructors motivate the trainees by letting them know in what kinds of situations the contents of lessons will be used in reality. At this time, VT instructors present the backgrounds written in the purpose of the lesson to the trainees. Therefore, the specific contents/situations need to be described in the purpose of the lesson to the extent where the trainees can imagine even if they do not know about the backgrounds.

### 4.2.3 Clarifying attainment objectives and training items

The attainment objectives and training items of each lesson are clarified through ability analysis, target analysis, and job breakdown.

In the lesson plan presented in section “4.2.1 Roles of lesson plans”, the target analysis results are reflected on the attainment objective and training items as indicated by the diagram below (Figure 4-1).

Please refer to section “3.4.2 Attainment objectives and training items”. You will find the details about how to describe attainment objectives and training items.

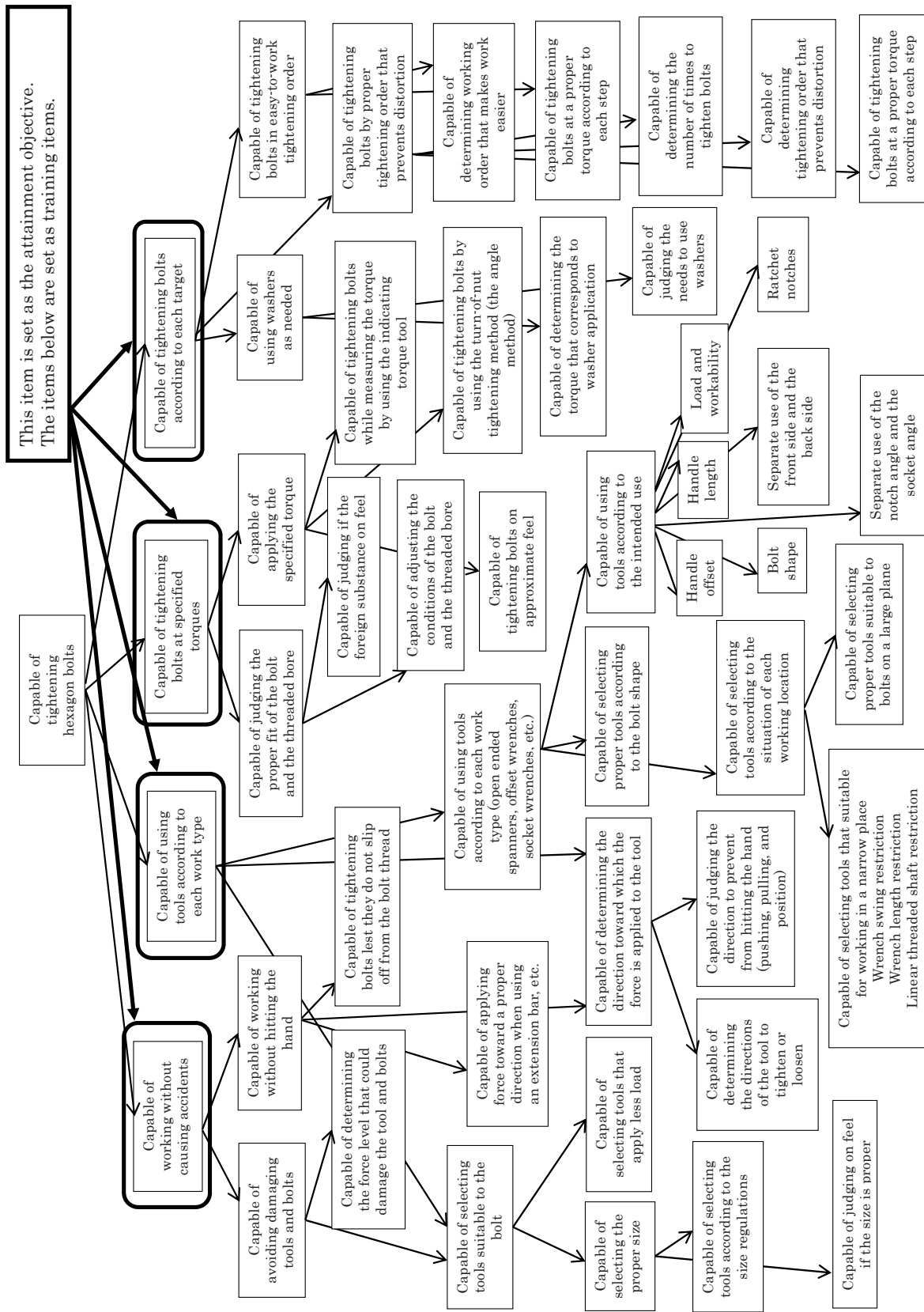


Figure 4-1 Target Analysis

#### 4.2.4 Lesson development

This section explains the basic concept of the lesson procedure. Lessons are implemented by combining “three training stages” and “four training activities”. In the portion of the lesson development of the lesson plan, the lesson procedure order based on this basic concept should be described.

##### (1) Three training stages

Lessons are implemented according to three training stages. These three training stages indicate each stage along a time line of the lessons. The role of each stage is described below in Table 4-3.

For example, the introduction stage takes about 5 minutes after the start of the lesson, while the next 50 minutes handles the “development” stage. The lesson is summarized and concluded in the last 5-minute section as the stage of summarization.

**Table 4-3 Three Training Stages**

Introduction	Stage of preparation for learning Release tension in the trainees, while attempting to attract their attention Show the whole picture of the lesson (purpose, attainment objectives, training items, and how to progress)
“Development”	Stage for instructing training items in order Implement motivation, presentation, application, and evaluation repeatedly according to each training item Implement in an easy-to-understand manner; Show each point clearly; Separate each item clearly Consider the duration of the trainee’s concentration to be able to sustain. Application is effective for acquiring training items and maintaining the trainee’s concentration Check the acquisition level of each trainee by conducting test, assignment, or questions
Summary	Stage of summarizing the lesson Organize training items and impress on the trainees the training items Check the matters achieved and not achieved Next lesson preview

##### (2) Four training activities

These four training activities indicate the variety of the activities provided by the VT instructors during the lesson in Table 4-4.

**Table 4-4 Four Training Activities**

Motivation	Motivate the trainees to learn Clarify what to do and what purpose it serves
Presentation	Show training items (verbally, visually, and by having them read the material) Make each item understandable and memorable (teach one training item at a time) Abstract → Specific
Application	Have the trainees use what is demonstrated (Make them be “capable of” doing assigned work) Have them get in the habit of using what is demonstrated
Evaluation	Check if the trainees have become “capable of” Observe, ask questions, and conduct test regarding what is demonstrated and applied Clarify the evaluations standards

## (3) Combination with the three training stages and four training activities

Lesson development is comprised by combining three training stages and four training activities described above. The table below (Table 4-5) shows a basic pattern of lessons where three training stages and four training activities are combined. Compare this table below with section “4.4 Example of Lesson Plans”, to see how this basic pattern can be applied to the actual lesson plan.

**Table 4-5 Basic Lesson Pattern**

	Motivation	Presentation	Application	Evaluation
Introduction	Today’s theme Learning purpose			Confirmation of trainees experience
		Learning objective Training items		
		How this lesson progresses		
“Development”	■ Training item 1			
	Presentation of the actual situations			
		Presentation of methods, intuitions, and knack		
			Try until finished	
				Confirm performance
	■ Training item 2			
	Presentation of the actual situations			
		Presentation of methods, intuitions, and knack		
		Try until finished		
			Confirm performance	
Summary				Check the trainee’s procedure and quality
		Point check How to improve		
	Encourage to apply to the actual situations			
	Next lesson preview			

In the above table, motivation, presentation, application, and evaluation are combined for each training item. Multiple training items could also be combined and demonstrated (presented) at once; however, VT instructors need to take into consideration how much the trainees can understand and memorize what they learn. Even the VT instructor try to make trainees to apply for what they have learned after long demonstration of many training items, trainees may have already forgotten what was demonstrated (presented) earlier. Considering such a point, therefore, the VT instructors need to determine the amount of training items that can be demonstrated (presented) at once during the lesson (like training item 1 & 2 in Table 4-5).

“Motivation” is activity that makes the trainees want to learn. The feeling of the trainees to learn varies depending on their desire to learn the lesson. This motivating activity does not need to be repeated if trainees are highly motivated with a strong desire to learn. On the other hand, for example, where the rate of students that go on to the next stage of education is high compared to the entire population, not all the trainees participate in the training with a clear will to learn. If this



is the case, the trainees might need to be motivated repeatedly. It should be noted that the trainees tend to be more highly motivated when the training lessons incorporate many activities such as “Application”, where the trainees do the work by themselves.

The target of each lesson is to become “capable of ...ing”. If they want to become “capable of” doing something, they have to try to do that by themselves at least once. This is called “Application”. Therefore, “Application” must be set even in lectures where you teach knowledge items such as theoretical subjects.

Additionally, “Presentation” is a stage where the VT instructors give “training”. Hopefully, during this activity, all the trainees are expected to learn. However there may be a case where some trainees could neglect their learning by failing to concentrate on the presentation by the VT instructors. In the contrast, “Application” is a stage where the trainees themselves do the work by themselves and it can be said that they are learning for certain. If the trainees do not learn by themselves, no matter how the VT instructors try to train them, the capabilities of the trainees do not reach to the attainment objectives. For this reason, it is essential to incorporate “Application” into each lesson on a timely basis.

“Evaluation” is a stage where the VT instructors confirm whether each trainee has acquired each training item and has achieved the attainment objectives for the lessons. The VT instructors evaluate and confirm whether each trainee has achieved the attainment objects by observing them during “Application” and by conducting proper test.

#### (4) How to describe the “development” columns

The section below shows how to describe the “development” columns.

**Table 4-6 How to Describe the “Development” Columns**

<p>“20 / 25” Describe the guide to the lesson hours “20” on the left indicates the approximate time required for this portion. “25” on the right indicates the approximate time spent from the start of the lesson to the end of this portion.</p>	<p>“■ Training item” Describe the training item This makes it easier to understand to which training item this portion corresponds. This reduces omissions in covering all training items.</p>	<p>“• Instructor’s behavior” Describe what the instructor will do with what intent in this section. Reading each “•” enables VT instructors to have the whole picture of the lesson.</p>
<p>“Development”</p> <p>Motivation</p> <p>20/25</p> <p>Presentation</p> <p>Introduction, “Development” and Summary Describe each activity of motivation, presentation, application, or evaluation. This description makes it easier to judge if prolonged presentation makes the trainees feel bored, if application activities are insufficient for the presentation, or if proper evaluation is prepared.</p>	<p>■ 1. Work without causing accidents</p> <p>1-1. Types and names of the tools and how to use (open ended spanner, offset wrench, socket wrench, and extension bar) .</p> <p>• Motivate the trainees by giving the following explanations</p> <p>• Explain the name of each tool and each part of the tool along with how to use as described below. However, demonstrate only how to tighten and loosen bolts. How to adjust the wrench handle position is not trained at this stage.</p> <p>• Open ended spanner, its head, and its handle Show how both ends are attached to the nut.</p> <p>• Offset wrench, its head, and its handle Show how both ends are attached to the nut</p> <p>• Socket wrench, extension bar, socket, spinner handle, and ratchet handle. Combine the spinner handle with the socket and show how to attach them to the nut.. Show how to combine the spinner handle with the socket and the extension bar Show how to combine the spinner handle with the socket and the extension bar. Show how the rotation direction can be changed by operating the switching lever on the ratchet handle.</p>	<p>• If you do not know the name of each tool, you will get confused in the subsequent explanation .</p> <p>• The name of tool to be used today and the outline of how they are used will be explained.</p> <p>Keywords Bulletize the items VT instructors have to mention in the square Describe these items so that everyone can conduct the lesson delivering almost the same content if this keyword list is referred. This does not mean merely to describe the lines to be read. By using these keywords, VT instructors need to speak incorporating their own experience.</p>

### 4.3 Instruction Methods Corresponding to Training Items

Within the lesson, the stage of “Presentation” → “Application” serves as the main framework of each lesson where the trainees learn training items. There are some types of training items. Depending on the type, the training method for trainees to acquire ability easily should be selected. This method is combined with “Presentation” and “Application”. This section classifies training items into knowledge, sensory-motor skills, intellectual management skill, and attitude in order to expound each basic training method.

#### (1) Instruction of knowledge

##### ① Repeated learning

Repeated learning is a learning method to memorize a certain fact by reading and writing it repeatedly. This method is used for learning merely to memorize the fact, which is more effective for learning to regenerate and recognize a certain amount of knowledge for exams. Knowledge which was memorized is generally forgotten at a certain rate. Re-learning of knowledge before it is forgotten can entrench the knowledge learned. For example, when memorizing 100 facts, suppose that you have finished learning 1 through 10 facts and then you learn 1 to 20 facts instead of going and learning 11 through 20 facts. This means that you have reviewed 1 through 10 facts before forgetting them.

However, humans forget what they learned in due course anyway unless they have opportunities to use the knowledge gained. This kind of learning method can be effective for an impending exams where the trainees are required to check their knowledge memorized within a specified period. However, this is not effective learning for the purpose of applying the knowledge gained to the actual situations in the real world.

##### ② Presentation of systematization and structuring

Knowledge can be unforgettable when memorized not as a random enumeration but as a system or a structure.

The example below, “How to explain 1”, explains knowledge as a random enumeration, which is difficult to memorize.

How to explain 1:  
 N-2F is manual welding which is conducted downward for average-thick steel plates without backboards.  
 A-1V is manual welding which is conducted vertically for thin plates with backboards.

The other example below, “How to explain 2”, explains as the structured knowledge, which is easy to memorize.

How to explain 2:  
 Welding types are indicated according to the following protocols.

N-2F			Plate direction	F: Downward; V: Vertical; H: Horizontal
			Plate thickness	1: Thin; 2: Average; 3: Thick
			Welding types	N: Manual welding (without backboards); A: Manual welding (with backboards)

N-2F indicates manual welding (without backboards) for average-thick plates and downward.  
 A-1V indicates manual welding (with backboards) for thin plates and vertical.

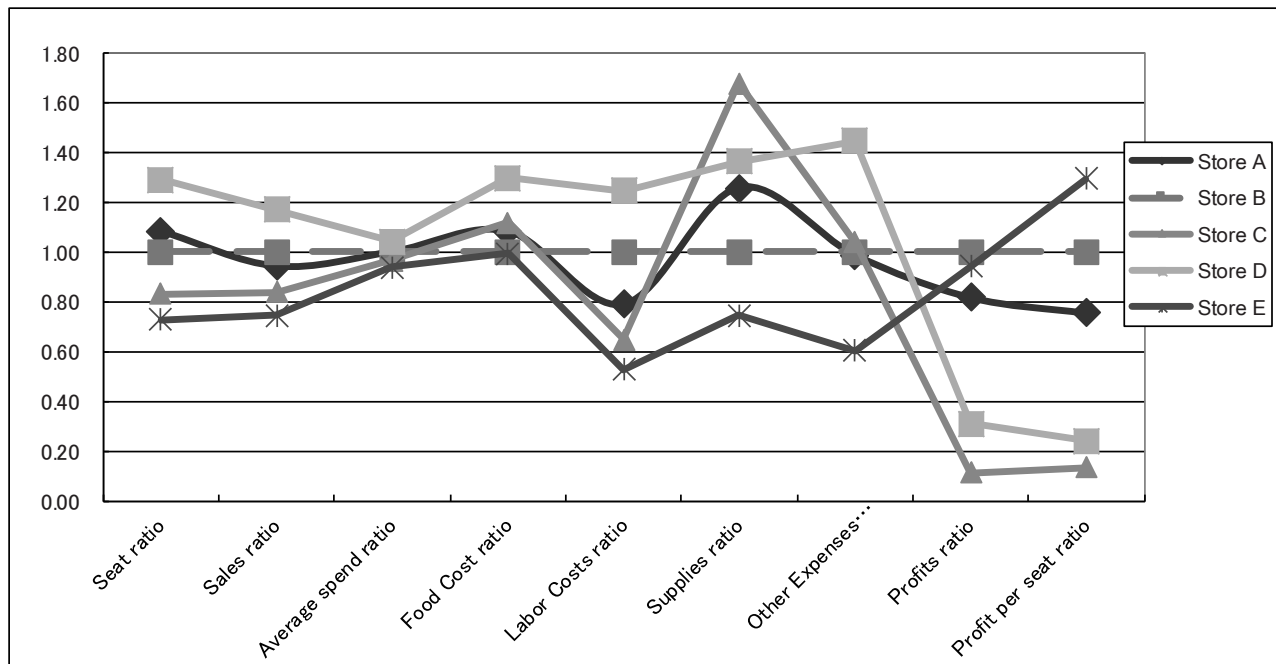
By memorizing the systems and structures, individual facts can be estimated or derived from the systems without memorizing such facts. This method can deal with a wide variety of situations. This means, even you have to deal with many situations, you only have to memorize a fewer number of facts.

③ Learning combined knowledge and situations to be applied

**Table 4-7 Sales Chart for Each Store**

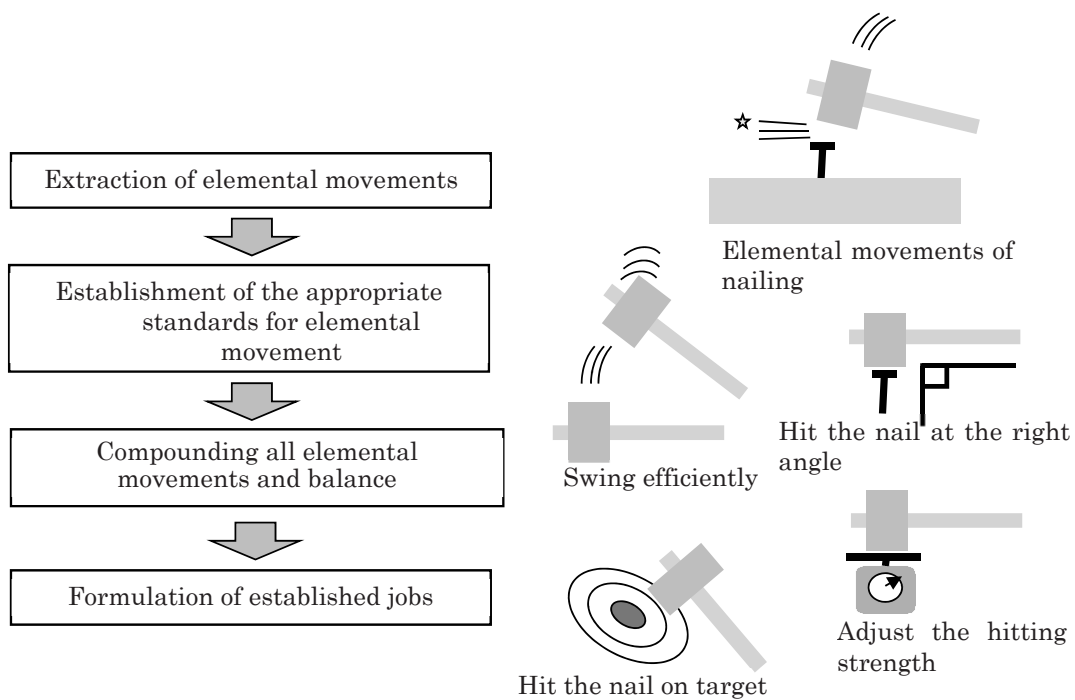
	No. Seats	Sales	Average spend	Food Cost	Labor Costs	Supplies	Other Expenses	Profits	Profits per Seat
Store A	52	14,035,890	2,499	4,351,126	3,649,331	1,122,871	3,087,896	1,824,666	35,090
Store B	48	14,878,040	2,496	4,017,071	4,612,192	892,682	3,124,388	2,231,707	46,494
Store C	40	12,491,940	2,410	4,497,098	2,998,066	1,499,033	3,247,904	249,839	6,246
Store D	62	17,404,500	2,599	5,221,350	5,743,485	1,218,315	4,525,170	696,180	11,229
Store E	35	11,088,350	2,347	3,991,806	2,439,437	665,301	1,885,020	2,106,786	60,194

	Seat ratio	Sales ratio	Average spend ratio	Food Cost ratio	Labor Costs ratio	Supplies ratio	Other Expenses ratio	Profits ratio	Profit per seat ratio
Store A	1.08	0.94	1.00	1.08	0.79	1.26	0.99	0.82	0.75
Store B	1	1	1	1	1	1	1	1	1
Store C	0.83	0.84	0.97	1.12	0.65	1.68	1.04	0.11	0.13
Store D	1.29	1.17	1.04	1.30	1.25	1.36	1.45	0.31	0.24
Store E	0.73	0.75	0.94	0.99	0.53	0.75	0.60	0.94	1.29



The above chart (Table 4-7) was created by using spreadsheet software. It is hard to memorize each function of the spreadsheet software, such as “how to add a border”, “how to calculate cells”, and “how to make a graphic chart”. Through learning each function one by one using the reference manual; Learning about adding a border or calculating cells in a process to solve the actual problems, such as calculating the average customer spending and profit rates, it is possible to memorize knowledge more robustly. This is associated with the acquisition of intellectual management skills, which will be explained in detail later.

(2) Instruction of sensory-motor skills



**Figure 4-2 Instruction of Sensory-Motor Skills**

(Source: Figure 2-28 Knack for instruction of sensory-motor skills on P. 107 of the 10th revised edition of “Theory and Practice of Vocational Training” edited by General Incorporated Foundation, the Vocational Training Materials Research Center)

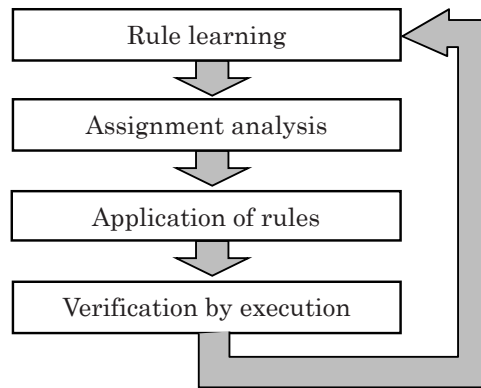
Regardless of whether conscious or unconscious, sensory-motor skills is the skill which largely involves element to control body movements by sense. Jobs such as nailing where the hammer needs to hit the nail accurately require various control factors when the hammer is swung.

When training such sensory-motor skills, VT instructors need to clarify elemental movements existing within the relevant job, and then attempt to have the trainees practice each single elemental movement one by one. VT Instructors need to have the trainees practice each single elemental movement first, followed by practicing several elemental movements. By doing so, the trainees becomes able to carry out the entire job.

**Table 4-8 Example of Nailing Work Instruction**

	Learning items	Training method
Extraction of elemental movements + Establishment of the appropriate standard for elemental movements	Hit the nail on target	• Practice adjusting the body position so that the hammer can hit the nail on target.
	Hit the nail at the right angle	• Practice adjusting the knee height and the width between feet placed so that the hammer can hit the nail at the right angle.
	Swing efficiently	• Practice swinging the hammer using the wrist and elbow as the axis of rotation. • The purpose is not hit on target. Practice by using a target without using nails.
Combining all elemental movements and balance + Formulation of established jobs	Swing efficiently + On target	• Practice to be capable of both swinging the hammer using the wrist and elbow as the axis of rotation + taking aim. Practice by using a target without using nails.
	Swing efficiently + On target + At a right angle	• Practice so that the following skills co-exist: swing the hammer using the wrist and elbow as the axis of rotation + take aim + hit the nail at the right angle. Start practicing by using nails.

## (3) Instruction of intellectual management skills



**Figure 4-3 Instruction of Intellectual Management Skills**

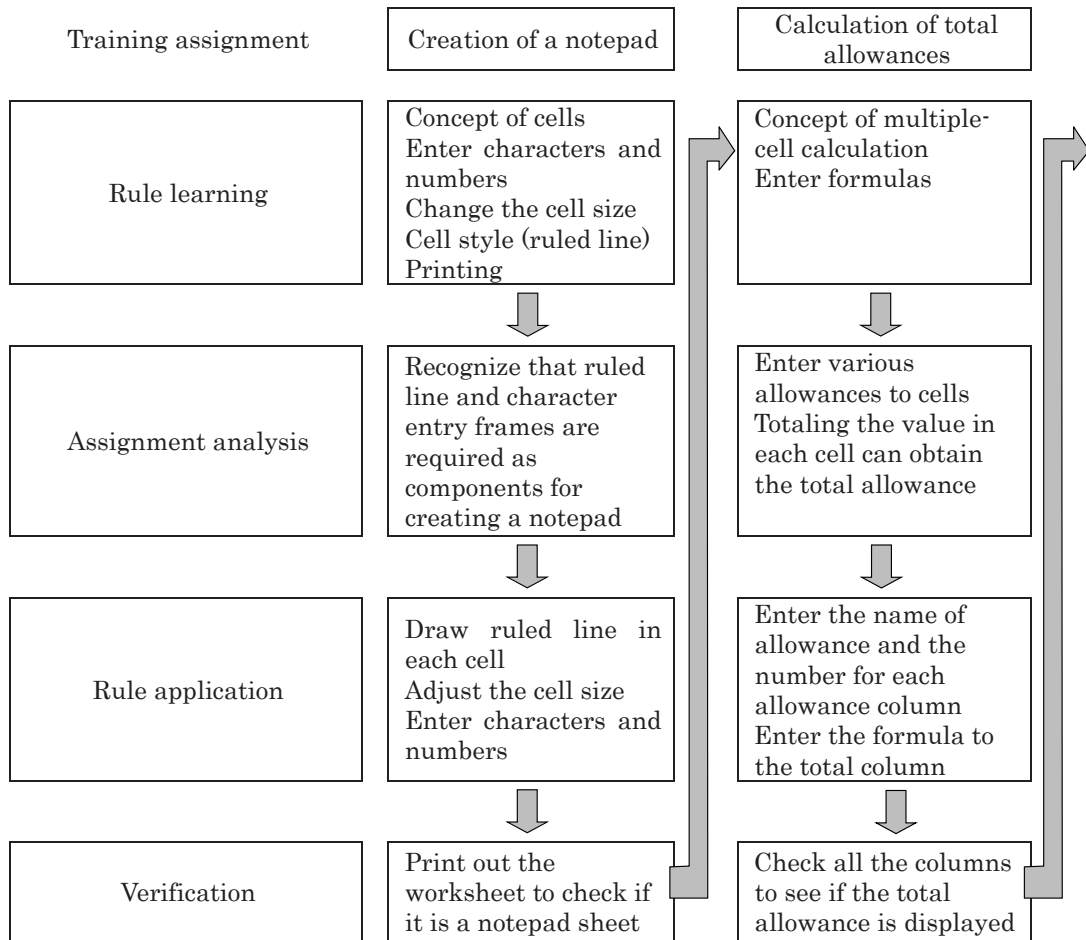
(Source: Figure 2-30 Knack for instruction of intellectual management skills on P. 108 of the 10th revised edition of “Theory and Practice of Vocational Training” edited by General Incorporated Foundation, the Vocational Training Materials Research Center)

An intellectual management skill is the skill to apply knowledge to the actual situations in the real world. First, the trainees need to learn the knowledge, and then they practice how to apply this knowledge to the situations in the real world.

Prepare assignments for the trainees that can be solved with less knowledge in the beginning, then VT instructors have them learn the knowledge which is required to work on the assignments given, and let them start to work on the assignments. Next, VT instructors may provide the trainees with complicated assignments which require more knowledge. By doing so, knowledge which can be applied to the actual situations is gradually increased.

When knowledge is applied to the assignments, as graphically illustrated in Figure 4-4, it is important to let the trainees themselves examine what they learn (See section “4.5 Design of Training Assignments”). If the VT instructor simply shows the procedure on how to work on this assignment, it would not be an effective method for learning of intellectual management for the trainees.

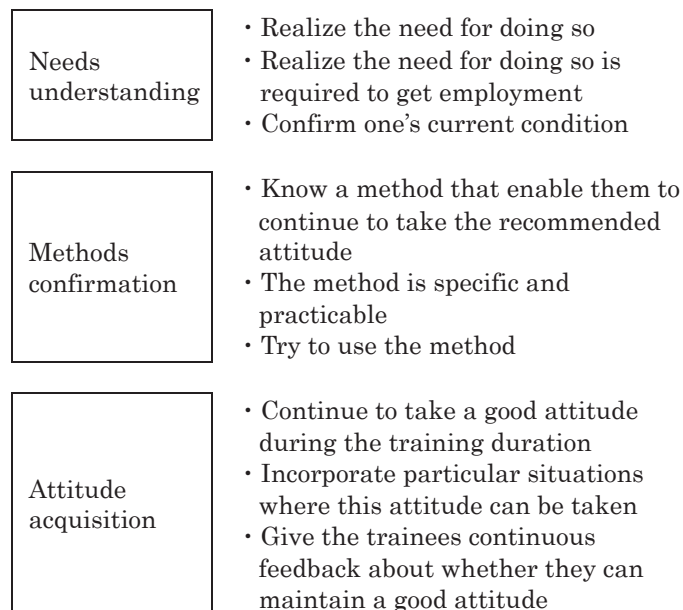
### 4.3 Instruction Methods Corresponding to Training Items



**Figure 4-4 Example of Spreadsheet Software Learning**

(Source: Figure 2-31 Example of spreadsheet software learning on P. 109 of the 10th revised edition of “Theory and Practice of Vocational Training” edited by General Incorporated Foundation, the Vocational Training Materials Research Center)

#### (4) Instruction of attitude

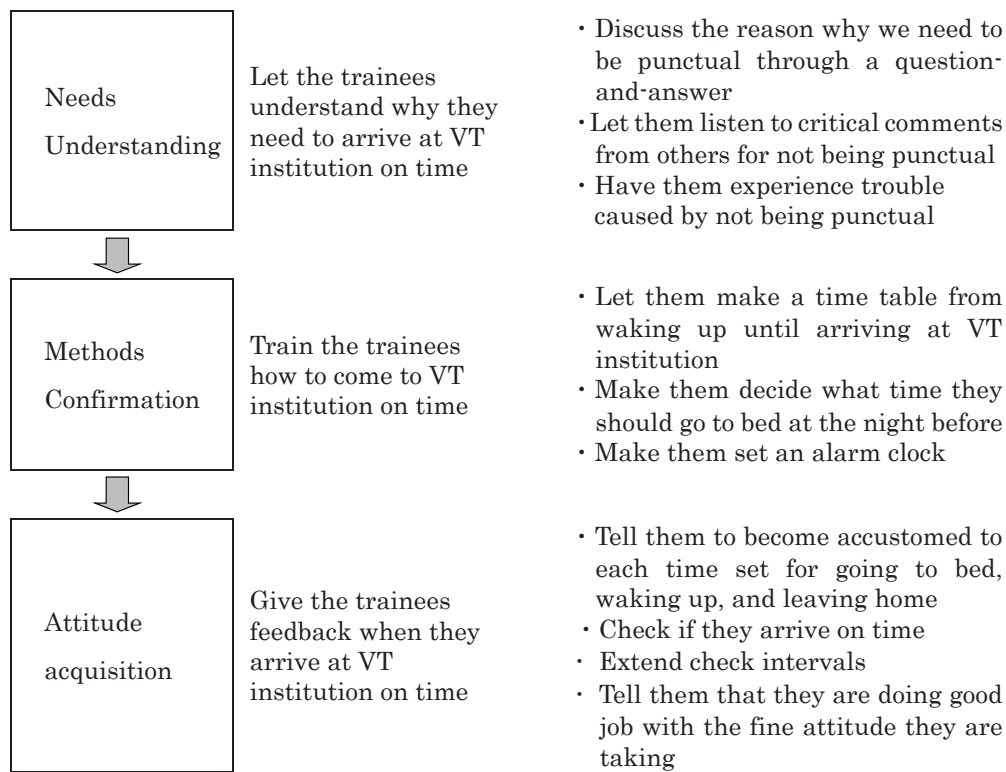


**Figure 4-5 Three Stages of Attitude Instruction**

(Source: Figure 2-38 Three stages of attitude instruction on P. 123 of the 10th revised edition of “Theory and Practice of Vocational Training” edited by General Incorporated Foundation, the Vocational Training Materials Research Center)

Attitude is one’s own tendency of behavior where he/she can select the method and result of a certain action taken. For example, as for going to school, there are individuals who try to arrive at school on time while some do not care if they arrive late. This example shows that both parties have different attitudes about the behavior of going to school. Instruction of attitude mentioned here will change such undesirable attitudes to favorable attitudes through instructions.

This instruction of attitude is implemented in three stages. The first stage is the stage where the instructors try to persuade and make them understand why fine attitude should be taken. In this stage, the trainees have to clear up all questions regarding taking the relevant attitude. The second stage trains the trainees how to take the relevant attitude. Explain the trainees specific methods by which they can take the required attitude so long as they actually work in this trained method. Until here, these instructions are conducted through lectures and practices. The third stage is to confirm whether the trainees are able to continuously take the required attitude. If the trainees fail to take the required attitude, the VT instructor tells them what they observed and encourages them to take the recommended attitude.



**Figure 4-6 Example of Instruction for Trainees That Arrive Late for Lesson**



### 4.4 Example of Lesson Plans

This section graphically illustrates the lesson plan which is described based on the basics of lesson planning and instructional tips that have been described up until here.

**Table 4-9 Example of the Lesson Plan**

Lesson Outline	
Lesson theme	How to tighten hexagon bolts
Purpose of Lesson	<p>There are many situations where bolts are tightened for a variety of purposes, such as assembly of metallic products, assembly of automobiles and machines, mounting of tire wheels, structuring of building structures, and assembling of electrical components to distribution boards. In these situations, failing to tighten bolts in a proper manner by using proper tools might damage bolts, products, and tools. Additionally, bolts could loosen over time in the future. Such a failure worsens work efficiency and increases unnecessary repair work, and will result in causing accidents at a later date. Furthermore, injuries could occur when over tightening bolts strongly or unscrewing them by swinging your arm widely and hit your hand on other parts around you.</p> <p>The purpose of this lesson is in order for workers in a wide variety of trades to acquire bolt tightening skills which they need to know as common skills.</p>
Attainment objective	<ol style="list-style-type: none"> <li>1. Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness</li> <li>2. Capable of using tools according to the assigned work</li> <li>3. Capable of tightening bolts at specified torques</li> <li>4. Capable of tightening bolts according to each object (washers, workability, and distortion)</li> </ol>
Training items	<ol style="list-style-type: none"> <li>1. Work without causing accidents               <ol style="list-style-type: none"> <li>1-1. Types and name of tools and how to use (open ended spanner, offset wrench, socket wrench, and extension bar)</li> <li>1-2. Work while preventing the cause of injuries                   <ol style="list-style-type: none"> <li>(a) Accident types (the tool “slipping off” while in use, sudden looseness)</li> <li>(b) Injury prevention measures</li> </ol> </li> <li>1-3. Work that prevents damage to bolts and tools                   <ol style="list-style-type: none"> <li>(a) Damage types (damaging bolt threads or spread/broken wrench end); (b) Bolt/tool size (the two-face width, metric bolts, and unified bolts); (c) Thread bore fitting to the bolt size, and the feel of the tools; (d) Methods that prevent damage</li> </ol> </li> </ol> </li> <li>2. Use of tools suitable for the assigned work               <ol style="list-style-type: none"> <li>2-1. Work types (bolt locations (flat or narrow), bolt accessories (brake hoses or plugs), and torque scale)</li> <li>2-2. How to use tools (open ended spanner, offset wrench, socket wrench, extension bar, ratchet handle, and adjustable wrench)                   <ol style="list-style-type: none"> <li>(a) Direction toward which force is applied; (b) Offset; (c) Handle length; (d) Bolt shape; (e) Load and workability; (f) Adjustment of the holding position (front and back sides, notch/socket angles, ratchet)</li> </ol> </li> <li>2-3. Selection of proper tools suitable for the assigned work</li> </ol> </li> <li>3. Tightening to the proper torque               <ol style="list-style-type: none"> <li>3-1. Concept of torque</li> <li>3-2. How to use indicating torque tools and the turn of nut tightening method (angele method)</li> <li>3-3. A feel for the reference torque (10, 30, 60, and 100N/m)</li> <li>3-4. Fit of the bolt and the threaded bore                   <ol style="list-style-type: none"> <li>(a) A feel for foreign substance (b) How to clean the threaded portion</li> </ol> </li> </ol> </li> <li>4. Tightening bolts according to each object               <ol style="list-style-type: none"> <li>4-1. Use of washers                   <ol style="list-style-type: none"> <li>(a) Purpose of washers; (b) Locations where washers are used; (c) How to apply torque to the washer</li> </ol> </li> <li>4-2. Easy-to-work order                   <ol style="list-style-type: none"> <li>(a) Temporary tightening that makes work easier; (b) From temporary tightening to full tightening</li> </ol> </li> <li>4-3. Tightening order that does not distort the product                   <ol style="list-style-type: none"> <li>(a) Inside → Outside; (b) Diagonal; (c) Multiple tightening (evenly)</li> </ol> </li> </ol> </li> </ol>
Eligible persons	<p>Workers who tighten bolts for their work</p> <p>Workers who can hold tools, such as socket wrenches, with both hands</p>

Chapter 4 Lesson Instruction Skills

Training hours	3 hrs.	Tools used, etc.	Bolt tightening training materials (See Figure 4-10 ①-⑧) Open ended spanner, 8x9, 10x12, and 12x14 Offset wrench, 8x9, 10x12, and 12x14, with 0°, 15°, and 45° for each A set of socket wrenches with 9.5mm square drive, 12.7mm square drive, hexagonal/dodecagonal socket wrenches, 12.7mm square drive hexagonal/dodecagonal socket wrenches Indicating torque tools, 10-50N/m and 20-130N/m
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Lesson procedure			
Classification	Hrs.	Development	Remarks
Introduction Motivation	5/5	<ul style="list-style-type: none"> <li>Showing the following work, and have the trainees realize that failing to tighten bolts in a proper manner might damage tools or bolts, or could cause injuries.</li> </ul> <div style="border: 1px solid black; padding: 5px;">                     1st: Tighten a bolt by using a socket wrench in the proper size. Tighten the bolt properly while noticing the following points.                      Direction where the hand does not hit anything: Hold the socket base (the front part of the wrench handle) and the end part of the handle                     <ul style="list-style-type: none"> <li>Explain that today's training is about this bolt tightening work.</li> </ul>                     2nd: Tighten a bolt by using a socket wrench with the long handle until wrenching off the bolt                      3rd: Using a socket wrench with the short handle, show how the bolt is difficult to be unscrewed, but suddenly becomes loosened                 </div> <ul style="list-style-type: none"> <li>Motivate the trainees by explaining the purpose as shown below:                     <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>The trainees will tighten bolts in various places in the future</li> <li>Failing to tighten bolts in a proper manner could damage tools and bolts, or even cause injuries.</li> <li>This might reduce production efficiency, resulting in dampening competitiveness.</li> <li>To learn how to tighten bolts properly</li> </ul> </div> </li> </ul>	
Presentation		<ul style="list-style-type: none"> <li>Explain the objective as follows:                     <div style="border: 1px solid black; padding: 5px;"> <ol style="list-style-type: none"> <li>Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness</li> <li>Capable of using tools according to the assigned work</li> <li>Capable of tightening bolts at specified torques</li> <li>Capable of tightening bolts according to each object (washers, workability, and distortion)</li> </ol> </div> </li> <li>Explain how training progresses as follows:                     <div style="border: 1px solid black; padding: 5px;"> <ol style="list-style-type: none"> <li>Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness</li> <li>Capable of using tools according to the assigned work</li> <li>Capable of tightening bolts at specified torques</li> <li>Capable of tightening bolts according to each object (washers, workability, and distortion)</li> </ol> </div> </li> </ul>	
"Development" Motivation	20/25	<ul style="list-style-type: none"> <li>1. Work without causing accidents                     <ol style="list-style-type: none"> <li>Types and names of the tools and how to use (open ended spanner, offset wrench, socket wrench, and extension bar).</li> </ol> </li> <li>Motivate the trainees by giving the following explanations                     <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>If you do not know the name of each tool, you will get confused in the subsequent explanation .</li> <li>The name of tool to be used today and the outline of how they are used will be explained.</li> </ul> </div> </li> </ul>	

4.4 Example of Lesson Plans

<p>Presentation</p>	<ul style="list-style-type: none"> <li>• Explain the name of each tool and each part of the tool along with how to use as described below. However, demonstrate only how to tighten and loosen bolts. How to adjust the wrench handle position is not trained at this stage.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Open ended spanner, its head, and its handle Show how both ends are attached to the nut</li> <li>• Offset wrench, its head, and its handle Show how both ends are attached to the nut</li> <li>• Socket wrench, extension bar, socket, spinner handle, and ratchet handle Combine the spinner handle with the socket and show how to attach them to the nut. Show how to combine the spinner handle with the socket and the extension bar. Show how the rotation direction can be changed by operating the switching lever on the ratchet handle.</li> </ul> </div>	
<p>Application</p>	<ul style="list-style-type: none"> <li>• Apply training as follows:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Showing some tools and each part of a tool, have the trainees answer their name.</li> <li>• Align the tools on the table. Say the name of each tool, and have the trainees pick up the one mentioned.</li> </ul> </div>	
<p>Evaluation</p>	<ul style="list-style-type: none"> <li>• Observing their performance, conduct evaluation as follows:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Check whether each of the trainees can say the correct tool name.</li> <li>• Check whether each of the trainees can pick up the correct tool.</li> </ul> </div>	
<p>“Development” Motivation</p>	<ul style="list-style-type: none"> <li>■ 1. Work without causing accidents</li> <li>1-2. Work while preventing injuries             <ul style="list-style-type: none"> <li>a) Accident types (the tools “slipping off” while in use, sudden looseness)</li> <li>b) Injury prevention measures</li> </ul> </li> <li>• Motivate the trainees by demonstrating the situations where accidents could be caused as follows:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Attach a largely-offset wrench to the bolt, apply force toward a proper direction to the extent that the bolt does not loosen.</li> <li>• Show that the offset wrench can slip off from the bolt by changing the force direction slightly upward</li> </ul> </div> <ul style="list-style-type: none"> <li>• Summarize this portion with the following words:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• When the tool slips off while the force is being applied, you might be injured by hitting your hand on surroundings. .</li> <li>• Need to learn how to prevent this from occurring.</li> </ul> </div>	
<p>Presentation</p>	<ul style="list-style-type: none"> <li>• Explain the accident types as follows:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• There are broadly two bolt-tightening accident types             <ol style="list-style-type: none"> <li>1. The tightening tool slips off from the bolt (The tool slips off due to different force direction or large offset)</li> <li>2. The bolt suddenly loosens</li> </ol> </li> </ul> </div>	
<p>Presentation</p>	<ul style="list-style-type: none"> <li>• By using an open ended spanner, explain how to prevent accidents from occurring when tightening bolts.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Tools with proper handle lengths</li> <li>• In principle, apply force toward the front (toward the trainee’s body front).</li> <li>• Check for objects that could cause injuries in the direction toward which the open ended spanner’s handle moves.</li> <li>• When the handle turns, the angle is heading for the obstacle.</li> <li>• The handle might be pushed by the hand palm without holding the handle where there is a certain obstacle. Introduce the handle turning method that does not cause injuries although the tool suddenly slips off.</li> <li>• Match the direction to which force is applied in the bolt tightening/loosening direction.</li> </ul> </div>	

Chapter 4 Lesson Instruction Skills

<p>Application</p>	<ul style="list-style-type: none"> <li>• Give the trainees the following training assignments to practice for safety use of the open ended spanner.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <p>Training assignment 1-1. Fixing the plate on the base (1) Fix both edges of the plate with six bolts by using an open ended spanner, and then remove them. Let them notice the following points.</p> <ul style="list-style-type: none"> <li>• Pull the spanner toward the body front.</li> <li>• When the trainee turns the wrench toward the obstacle, tell them to push the wrench without holding the handle.</li> <li>• At that time, have them hold the wrench head.</li> <li>• Make them confirm to apply force in the bolt tightening/loosening direction.</li> </ul> </div>	<p>Training materials ①, ③, ⑤, and ⑥</p>
<p>Evaluation</p>	<ul style="list-style-type: none"> <li>• Evaluate the trainee’s performance condition from the following viewpoints:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• The trainee pulls the wrench toward the body front</li> <li>• When the trainee turns the wrench toward the obstacle, the trainee pushes the wrench by their palm without holding the handle.</li> <li>• The trainee applies force in the direction toward which the bolt is turned.</li> </ul> </div>	
<p>Presentation</p>	<ul style="list-style-type: none"> <li>• By using an offset wrench, explain how to prevent accidents from occurring when tightening bolts.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Offset wrenches have various offsets.</li> <li>• The conditions to match with the bolt turning direction become very strict.</li> </ul> </div>	
<p>Application</p>	<ul style="list-style-type: none"> <li>• Give the trainees the following training assignments to practice safety use of the offset wrench.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Training assignment 1-2. Fixing the plate on the base (2)</li> <li>• Let them use long offset wrenches of 0°, 15°, and 45°.</li> <li>• Let them check the direction toward which force is applied.</li> <li>• Let them experience the situation where the tool easily slips off when the direction is changed slightly.</li> <li>• Tell them to continuously pay attention to the force direction.</li> </ul> </div>	<p>Training materials ①, ③, ⑤, and ⑥</p>
<p>Evaluation</p>	<ul style="list-style-type: none"> <li>• Evaluate the trainee’s performance condition from the following viewpoints:</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• The force direction is matched with each offset angle of the offset wrench.</li> </ul> </div>	
<p>Summary Presentation</p>	<p>Today’s training contains the following items:</p> <div style="border: 1px solid black; padding: 5px;"> <ul style="list-style-type: none"> <li>• Safety work methods</li> <li>• Proper selection of tools</li> <li>• Applying proper torque</li> <li>• Proper procedure of tightening bolts to fix products in various shapes and proper use of washers</li> </ul> </div> <ul style="list-style-type: none"> <li>• Tell them that you have confirmed that all the trainees have achieved the following attainment objectives through training assignments worked on.</li> </ul> <div style="border: 1px solid black; padding: 5px;"> <ol style="list-style-type: none"> <li>1. Capable of working on bolts and nuts without injuries, without damaging bolts, threaded bores, or tools, and without causing looseness</li> <li>2. Capable of using proper tools according to the work</li> <li>3. Capable of tightening bolts at specified torques</li> <li>4. Capable of tightening bolts according to each object (washers, workability, and distortion)</li> </ol> </div>	

#### 4.4 Example of Lesson Plans

Motivation		<p>Summarize today's lesson so that the trainees apply what they learned to the actual work as follows:</p> <ul style="list-style-type: none"><li>• The trainees can adapt to bolt tightening work done in various places from now on</li><li>• The trainees can use tools properly without causing injuries or damaging tools and bolts.</li><li>• The trainees can enhance production efficiency as part of maintaining competitiveness.</li><li>• The trainees have to utilized what they learned today during their actual work.</li></ul>	
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## 4.5 Design of Training Assignments

### 4.5.1 Importance of designing training assignments

Training assignments should be designed strategically. The main target of VT is trade skills. It is impossible for the trainees to acquire trade skills merely by attending lectures or observing performance by the VT instructors. The trainees can acquire trade skills only by experience from accumulating practice of the skills. This is the ultimate reason why more than half of the VT curriculum is devoted to practice training. As shown in the figure below (Figure 4-7), practice means to carry out the training assignments given by the VT instructors, which serves as “learning through action”. Additionally, this “learning through action” based on the idea of training assignments actually forms the core of VT.

In most cases, training assignments are designed as a group of highly-related assignments. This is because the targeted ability of training assignments is the integral and practical ability. Designing a group of assignments (assignments A, B, C...) is equal to programming “learning through action”. Therefore, it is not an exaggeration to say that these training assignments reflect the competence and educational consideration of the VT instructors. The VT instructors have to design training assignments strategically in order for the trainees to achieve the attainment objectives completely and rationally.

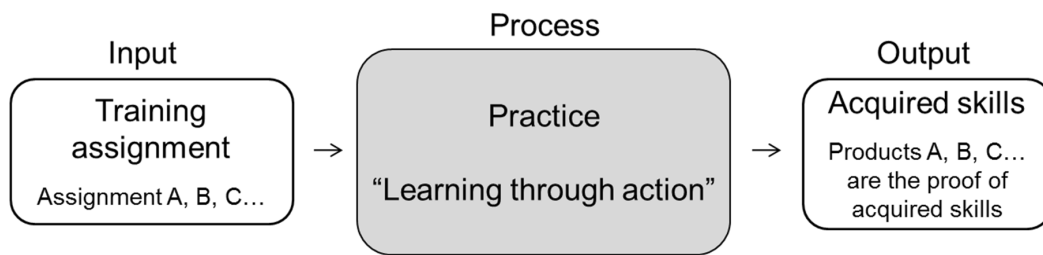


Figure 4-7 Relationship Between Training Assignments and Practices in VT

### 4.5.2 Design processes for training assignments

Training assignments that are rationally designed within the scope of a certain process help the trainees acquire trade skills smoothly. This section explains the design processes for training assignments by dividing them into three steps. Figure 4-8 shows these three steps on a conceptual basis.

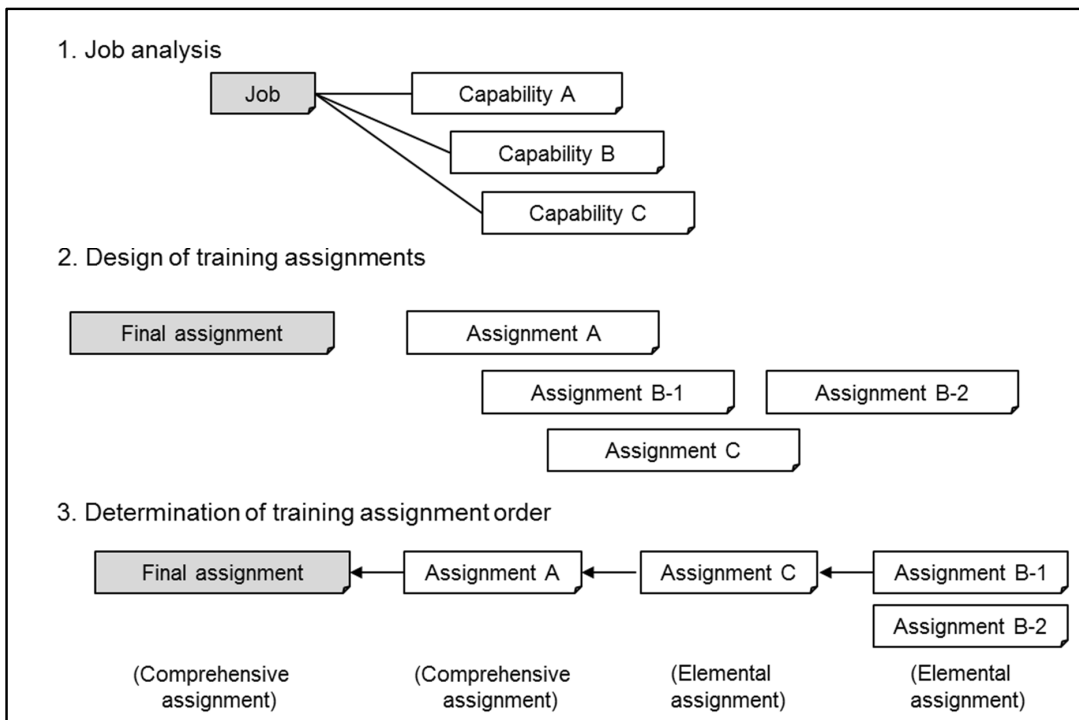


Figure 4-8 Design Process for Training Assignments

(1) Job analysis

Analyze the targeted job (ability) and break it down into ability components (skills and attitude) that compose the job. Figure 4-9 shows an example of job analysis based on target analysis.

(2) Design of training assignments

Training assignments are designed in steps according to the characteristics of each ability that is a component of the job. Training assignments are “assignments for learning through action”. The VT instructors need to have an image of the learning behavior of the trainees when designing training assignments. Furthermore, they make effort so that the trainees can feel the importance and enjoyment of the training content. The final assignment shown in Figure 4-11 corresponds to the practical test which is a typical example of a comprehensive training assignment.

(3) Determination of training assignment order

Presenting order of training assignments has to be determined so that training assignments are given step by step from elemental to comprehensive assignments based on consideration of the difficult level of each assignment and required skills.

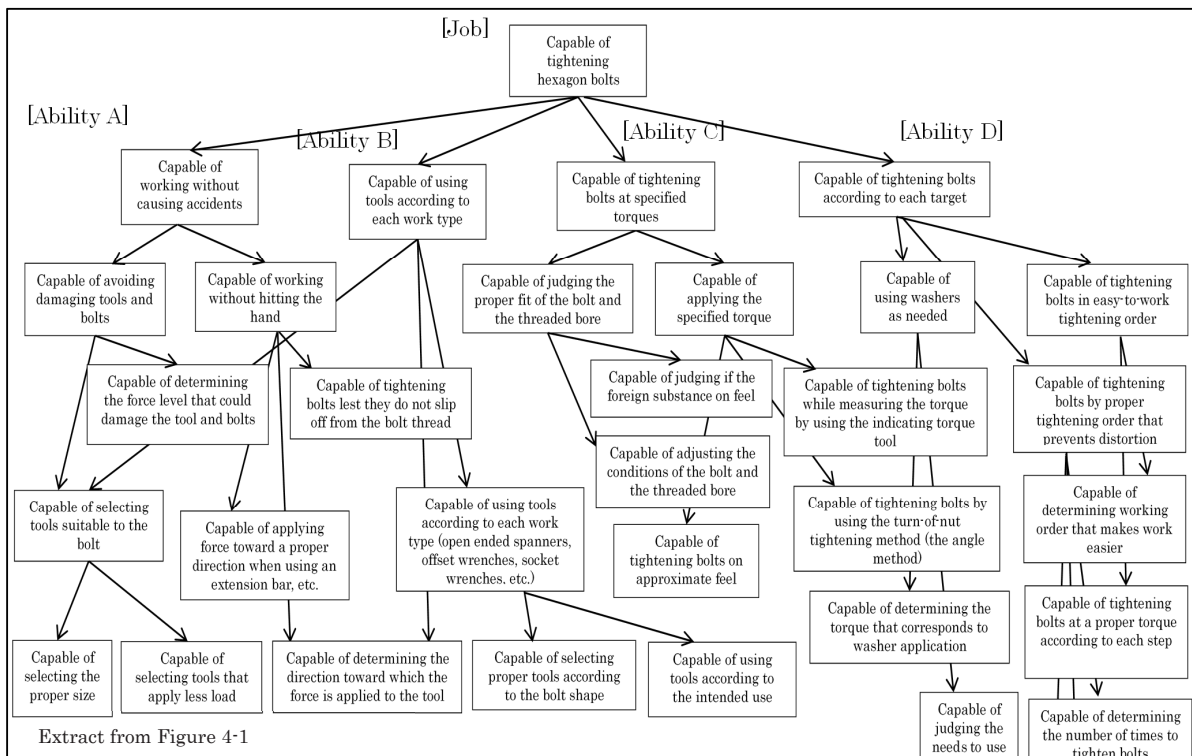


Figure 4-9 Example of Job Analysis with the Use of Target Analysis

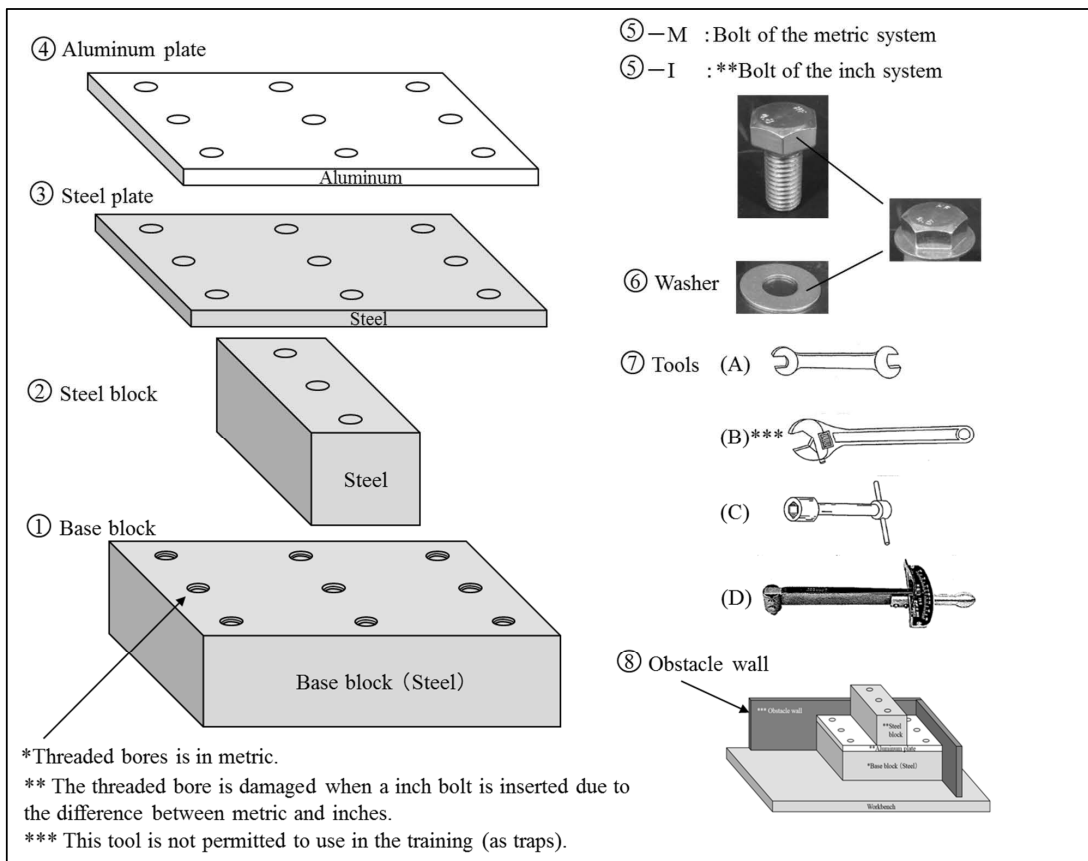
4.5.3 Example of training assignments design

As a case study, this section introduces “tightening by using hexagon bolts”. Table 4-10 shows the outline of this training. Tightening bolts appears to be a simple job to do. However, failing to tighten bolts in a proper manner could damage bolts and threaded bores. Bolt looseness could cause disasters or accidents. Moreover, if a tightening tool slips off from a bolt while applying large force on a tool handle, the operator could be injured by hitting his/her hand against another object or by falling down. Figure 4-10 shows an example of training materials and tools used during training for the tightening hexagon bolts according to this plan’s outline. Figure 4-11 shows an example of the final assignment which is given in the final stage of this training. This final assignment can be implemented by combining the training materials and the tools shown by Figure 4-10. Figure 4-12 shows a design flow for the training assignment for the tightening hexagon bolts. In the flow of this figure, job analysis on tightening hexagon bolts is conducted at the beginning and extract the abilities that compose the relevant job. Next, this flow shows training assignments A through D which were considered for the purpose of developing each ability. The numbers from ① to ⑧ as written remarks under each training assignment are the number of training material and the tool shown in Figure 4-10. Finally, this flow shows the order of training assignments

which was determined based on consideration for the difficulty level of each training assignment and required skills.

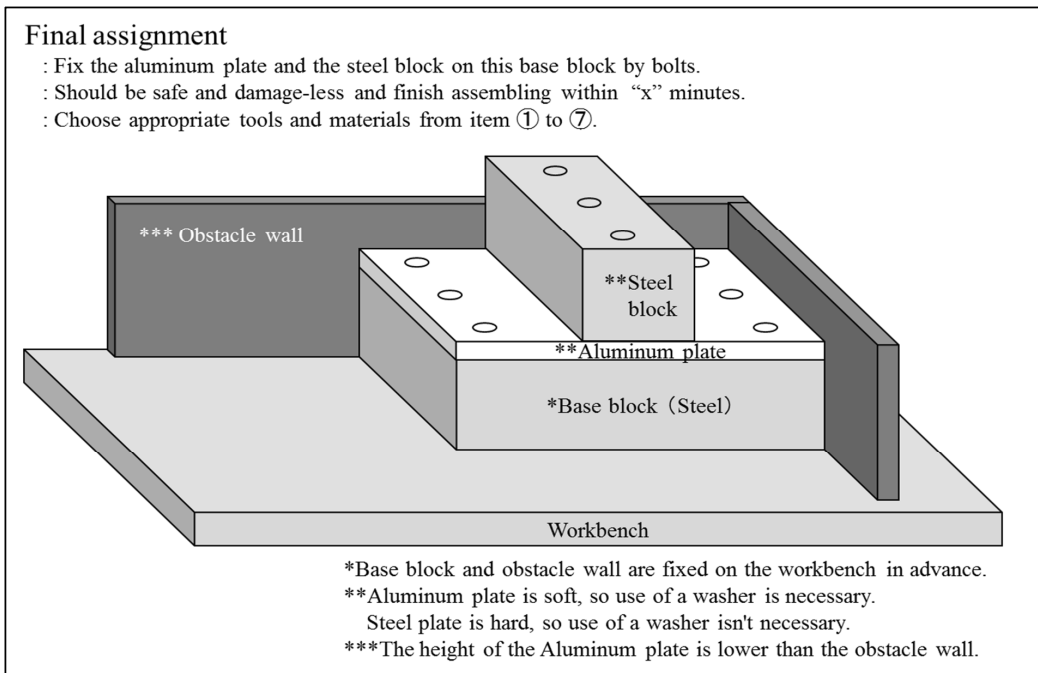
**Table 4-10 Training Outline of “Tightening Hexagon Bolts”**

Target	Tightening hexagon bolts
Purpose of lesson	<p>[Purpose] The purpose of this lesson is in order for workers in a wide variety of trades to acquire bolt tightening skills which they need to know as common skill.</p> <p>[Importance] Tightening bolts appears to be a simple job to do. However, failing to tighten bolts in a proper manner could cause the following problems.</p> <p>(1) Bolts, products, or tools are damaged.</p> <p>(2) Bolts are loosened.</p> <p>(3) When the tightening tool slips off from the bolt while applying large force on the tool handle, the operator could be injured by hitting his/her hand against another object or by falling down.</p> <p>[Application] This skill is applied to the following trades: Assembly of metallic products, assembly of automobiles, structuring building structures, and assembly of distribution boards.</p>
Attainment objectives	<p>A. Capable of working without causing accidents (injuries) and damage (to bolts, threaded bores, and tools)</p> <p>B. Capable of using tools suitable for the working conditions</p> <p>C. Capable of tightening bolts at a proper torque</p> <p>D. Capable of tightening bolts according to the materials and forms of the targeted object to be tightened (Use of washers, distortion prevention for the targeted object, consideration on workability, etc.)</p>
Eligible persons	Trainees of Metallic Processing, Machining, Automobile Maintenance, Electrical Engineering, and Architecture
Training hours	xx hours



**Figure 4-10 Example of Materials and Tools Used for Training of Tightening Hexagon Bolts**





**Figure 4-11 Example of the Final Training Assignment**

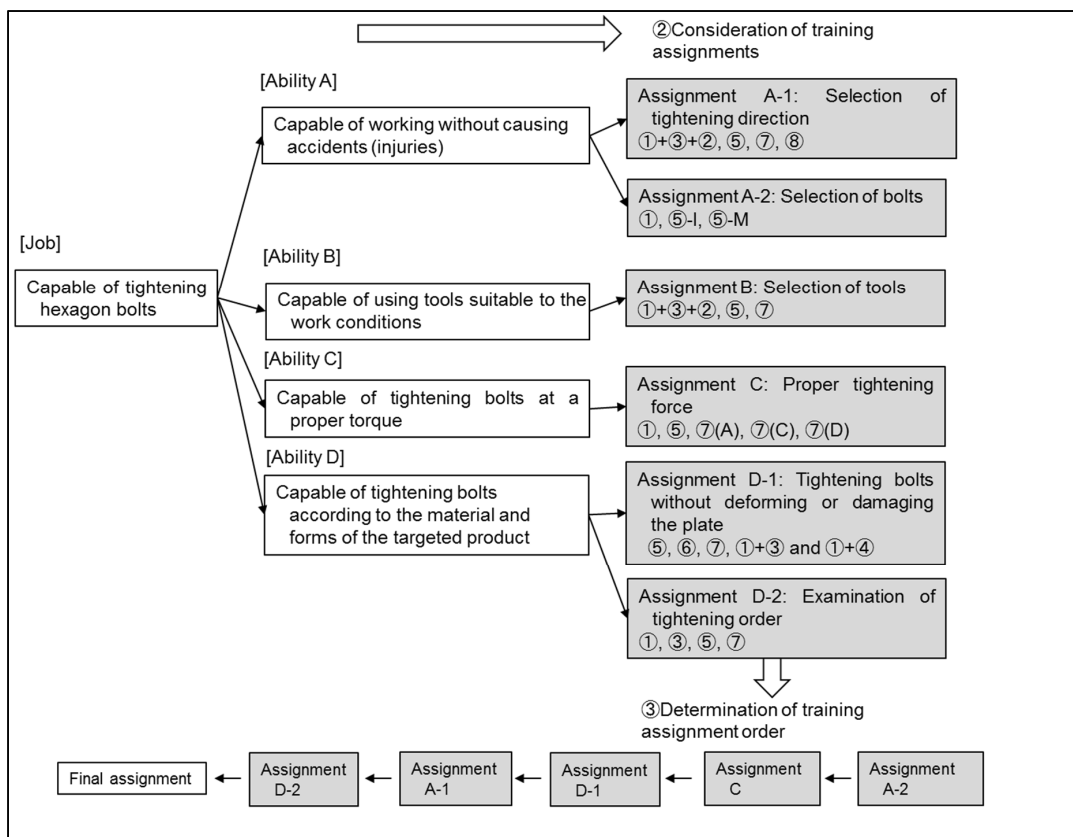


Figure ① through ⑧ are the numbers of each kind of material and tools shown in Figure 4-10.

**Figure 4-12 Example of Designing a Training Assignment**

#### 4.5.4 Training assignment types

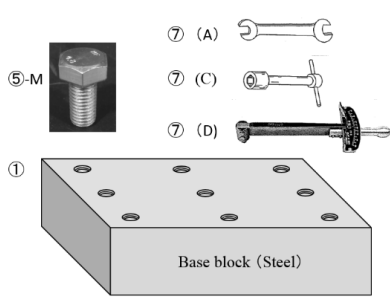
Section “4.3 Instruction Methods Corresponding to Training Items” described examples of instructing knowledge, skills, and attitudes. This section goes further by showing training assignment examples in detail. The examples of training assignments described below are those considered in training assignment ② of Figure 4-12.

(1) Training assignments intended to develop sensory-motor skills

Sensory-motor skills consist mainly of recognition of situations by sensory organs and subtle physical movement which corresponds to what is recognized. A familiar example of these skills is bicycle riding. As for VT, the handle operation of machine tools, and operation of hand tools such as hammers and metal cutting saws are regarded as sensory-motor skills. The figure below (Figure 4-13) shows an example of training assignment intended to develop sensory-motor skills.

[Training assignment C: Proper tightening force]

- ◆ This training assignment is for learning the feel of the force level adjustment for tightening bolts by using tightening tools.
- ◆ Prepare indicating torque tools ⑦(D) to measure the tightening force, and have the trainees measure the tightening force applied to bolts by feel.
- ◆ Have them practice with an open ended spanner ⑦(A) until the bolt tightening force by feel remains within  $\pm 5\%$  of the force specified.



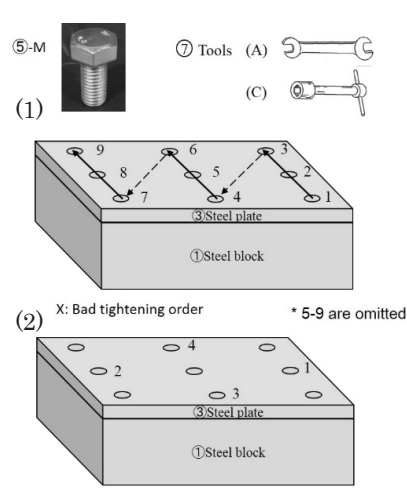
**Figure 4-13 Example of Training Assignments for Developing Sensory-Motor Skills**

(2) Training assignments intended to develop intellectual management skills

Intellectual management skills consist of abilities of judgment and planning. A familiar example of these skills is examining a route when going to several shops for shopping by bicycle. (Similar assignment is shown in Figure 4-14 as an example of examination of tightening order. In VT, set up work (preparation) and programming for information processing are fall within these skills.

[Training assignment D-2: Examination of tightening order]

- ◆ This training assignment is for training the examination of rational tightening order of bolts.
- ◆ The upper diagram (1) shows a bad example where bolts are tightened from the far right. In this case, bolts are tightened with the left edge of the steel plate ③ floating.
- ◆ The lower diagram (2) shows an example of tightening bolts diagonally to control plate floating and deformation.
- ◆ Other tightening orders can also be considered in this training assignment. VT Instructor can also expect the trainees to enhance their inquisitive spirit by making presentations about the tightening order they considered and their reasons.



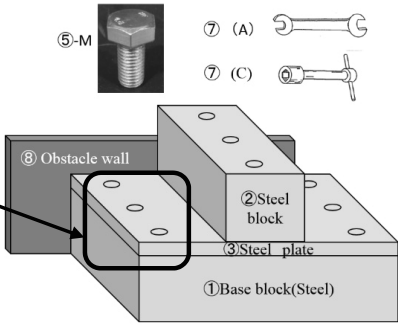
**Figure 4-14 Example of Training Assignments for Developing Intellectual Management Skills**

(3) Training assignments intended to develop fine attitudes

Attitudes are broadly divided into general attitudes, such as “to be able to say greetings” and “to be able to arrive on time”, and attitudes closely-related to duty performance, such as “to be able to give a clear cue in collaborative work projects” and “to be able to observe predetermined procedures and rules”. The later attitudes, which are closely-related to performance duties, are the main target for training assignments for this practice. Figure 4-15 shows an example of training assignments intended to develop fine attitudes.

[Training assignment A-1: Selection of tightening direction]

- ◆ This training assignment is to learn the attitude to observe keeping rules.
- ◆ Explain disaster cases caused due to the tightening of bolts by pushing the tool toward the obstacle.
- ◆ ③; Using the open ended spanner ⑦ (A) may cause injury to the hand due to the obstacle wall when tightening bolts in the left side line bores ③.
- ◆ Prepare the tool ⑦(C) necessary for the above mentioned case in the tool room. Only those trainees who took the trouble to get the tool and tighten the bolts to the proper posture will pass this training.



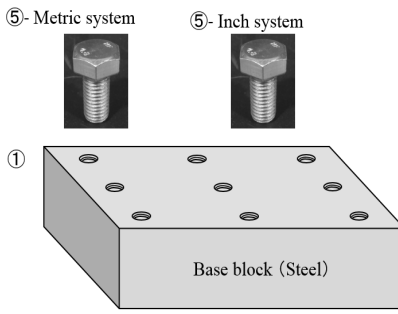
**Figure 4-15 Example of Training Assignments for Developing Fine Attitudes**

(4) Elemental training assignments and comprehensive training assignments

As described in section “3.6.1 Training assignment”, training assignments are broadly divided into elemental training assignments and comprehensive training assignments. Elemental training assignments are frequently used in the first half of training, while many comprehensive training assignments are used in the second half. Each of the elemental training assignments is hard to be established as an actual duty, but it is necessary for acquiring elemental abilities that serve as the foundation of duty performance. Therefore, many elemental training assignments take a simple form which is not seen in the actual work site. The figure below (Figure 4-16) shows an example of elemental training assignments.

[Training assignment A-2: Selection of bolts]

- ◆ This training assignment trains on how to select bolts fitting to threaded bores.
- ◆ There are inch bolts and metric bolts. Those bolts having similar diameters can be inserted into the bore to a certain degree. Tightening such bolts forcibly can damage them.
- ◆ Prepare more than 10- inch bolts and more than 10- metric bolts, respectively.



**Figure 4-16 Example of Elemental Training Assignments**

Comprehensive training assignments are for building the vocational capabilities set as the training objective that match as much as possible to the reality of work site. These training assignments can be implemented only when some elementary abilities are combined. Therefore, comprehensive training assignments tend to take forms that are close to duties assigned at the actual work site. Figure 4-17 shows an example of comprehensive training assignments. This figure explains the content shown in Figure 4-11 in detail.

[Final assignment]

- ◆ This training assignment comprehensively evaluates the proficiency level of each capabilities from A through D extracted by job analysis as shown in Figure 4-12.
- ◆ Due to the obstacle wall, the trainee needs to select proper tools depending on the tightening location. Those trainees who tightened the bolts into the lined up threaded bores on the left edge by the open ended spanner are rejected due to unsafe operation for pushing the open ended spanner toward the obstacle.
- ◆ Use of the adjustable wrench is not permitted as commented in a footnote \*\*\* of Figure 4-10. Therefore, those trainees who use this tool are rejected.
- ◆ Points are deducted when washers are not used for tightening bolts into the aluminum plate.
- ◆ There are nine threaded bores to be tightened; have each trainee write their own tightening order on a sheet of paper and submit it to the VT instructor.
- ◆ The threaded bores are in metric. Inch bolts are actually mixed with metric bolts. Those trainees who cannot select metric bolts from mixed bolts correctly are rejected.
- ◆ A quantitative evaluation on the trade skill level will be possible by notifying trainees of the time limit and proper tightening torque.

**Figure 4-17 Example of Comprehensive Training Assignments**

## 4.6 Evaluation Design

### 4.6.1 Importance of evaluation design

No matter how good training assignments are completed, it does not make any sense if the VT instructors cannot evaluate the assignments results properly. In order to conduct proper evaluations, the VT instructors need to take care of the four performance attributes, which are described in section “3.5.3 Four performance attributes of training evaluation (adequacy, objectivity, reliability, and economic efficiency)”, including balance between these attributes. Particularly, evaluation should conform with the intention of each of the training assignments described in section “4.5.4 Training assignment types”, namely the development of (1) sensory-motor skills, (2) intellectual management skills, and (3) attitude. Failing to do so reduces the adequacy of evaluation. For this reason, the VT instructors also have to design assignment evaluations as strategically as training assignments.

### 4.6.2 Targets for assignment evaluation

Section “3.5.6 Outline of evaluation methods (4) Practical skills test” described that there are four evaluation targets when practical skills tests and training assignments are evaluated. They are ③working result, ④working procedure, ①working attitude, and ②working time. The table below (Table 4-11) shows how each of these targets is evaluated.

An important point in designing evaluations is that all of these four evaluation targets are included. Evaluation fineness can of course vary depending on each evaluation target. Excellent VT instructors tailor their evaluations to the design of training assignments and vary the fineness of evaluations.

**Table 4-11 Targets for Assignment Evaluation**

Evaluation target	Evaluation contents	Example
Working results	<ul style="list-style-type: none"> <li>Quality of results submitted</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation of dimensions and precision of products manufactured by using a lathe</li> <li>Evaluation of programs created and their operating and execution speed</li> <li>Evaluation of dimensions and precision of furniture made by woodworking</li> <li>Evaluation of operation and beauty of electrical circuits with components installed</li> </ul>
Working procedures	<ul style="list-style-type: none"> <li>Is standard procedure used for this work?</li> <li>Is the work rational and efficient?</li> <li>Is the work done safely?</li> </ul>	<ul style="list-style-type: none"> <li>Lathe machining procedure</li> <li>Program designing procedure</li> <li>Furniture making procedure</li> <li>Electrical circuit designing procedure</li> </ul>
Working attitude	<ul style="list-style-type: none"> <li>How to face with safety consciousness, quality enhancement, and work efficiency improvement</li> </ul>	<ul style="list-style-type: none"> <li>Was proper attention given so as not to damage the product during lathe operation?</li> <li>Was proper attention given to avoid injuries by tools or chips during lathe operation?</li> <li>Is the work place organized and cleaned to enhance workability?</li> <li>Is the program developed highly readable?</li> <li>Does the program contain comments that help the program’s understandability?</li> <li>Was proper attention given so as not to damage the product during woodworking?</li> <li>Was proper attention given to avoid injuries during woodworking?</li> <li>Was proper attention given to avoid burn injuries during the soldering work?</li> <li>Was proper attention given to avoid losing components when assembling electrical circuits?</li> </ul>
Work time	<ul style="list-style-type: none"> <li>Hours spent for completion</li> </ul>	<ul style="list-style-type: none"> <li>Was the work completed within the standard working hours?</li> <li>Working hours are measured for each working process</li> <li>How many products can be created within a specified time?</li> </ul>

### 4.6.3 Point allocation plan for training assignments

Training assignments have a wide variety of evaluation targets; therefore, VT instructors need to determine point allocation in advance. At this time, ensuring consistency with “① job analysis” which was considered in section “4.5.2 Design processes for training assignments” is important.

For example, “Training assignment C: Proper tightening force” in section “4.5.4 Training assignment types” is a training assignment for the trainees to acquire “ability C” shown in Figure 4-9. The following items are the subordinate objectives of “ability C”.

- Capable of judging the proper fit of the bolt and the threaded bore
  - Capable of judging the foreign substance on feel
  - Capable of adjusting the conditions of the bolt and the threaded bore.
- Capable of applying the specified torque
  - Capable of tightening bolts while measuring the torque by using the indicating torque tool
  - Capable of tightening bolts by using the turn of nut tightening method (the angle method)
  - Capable of tightening bolts by approximate feel

In other words, the VT instructors have to determine point allocation including the above items as evaluation targets. For the purpose of ensuring consistency, the above items have to have high point values.

With that in mind, a rough point allocation plan is prepared as seen in the table below (Table 4-12). According to each evaluation target, this table clarifies the corresponding relationship between each evaluation target and subordinate objectives. For this reason, high point values are allocated when there are corresponding subordinate objectives, otherwise low point values are allocated. By doing so, consistency can be achieved in point allocation.

The point allocation plan decided in this table shows the highest point values for evaluation of each evaluation target.

- Within  $\pm 5\%$  of the specified tightening force → 30 points
- Within  $\pm 8\%$  of the specified tightening force → 15 points
- Within  $\pm 10\%$  of the specified tightening force → 5 points
- Greater than  $\pm 10\%$  of the specified tightening force → 0 points

Allocating points as shown in example above, each target can be evaluated on a step by step basis or evaluated with multiple check items.

As for “working attitude”, in many cases, the point-deduction system is adopted for evaluation. This table also adopts the point-deduction system, while the highest deduction-point is shown on point allocation column. This system also evaluates each evaluation target on step by step basis. For example, 4 points are deducted every time one scratch is found on a bolt or the base block (maximum of 20 points are deducted).

**Table 4-12 Point Allocation Plan**

Evaluation target		Corresponding subordinate objective	Point allocation
Working result	Within $\pm 5\%$ of the specified tightening force.	Capable of tightening bolts by approximate feel.	30
	Bolts used are fitting to the threaded bore.	Capable of adjusting the condition of the bolt and the threaded bore. Capable of judging the foreign substance by feel.	20
Working procedures	Capable of measuring the tightening force by using the indicating torque tool.	Capable of tightening bolts while measuring the torque by using the indicating torque tool.	20
	Tightening tools are used by correct procedures.	Capable of tightening bolts by using the turn of nut tightening method (the angle method). Capable of tightening bolts by approximate feel.	20
Working attitude	Bolts or the base block are scratched.		(-20)
	Tools or materials are dropped.		(-10)
	Bolts are damaged.		(-30)
Working time	All work was completed within the specified working time.		10

#### 4.6.4 Highly-objective marking

Training assignments are frequently marked by the VT instructors on their own subjective judgments while evaluating the achievements and observing the trainees' behavior. However, the more the marking standard varies depending on each VT instructor, the lower the evaluation objectivity becomes. Therefore, necessary efforts should be made in order to enhance objectivity. To achieve this, the marking standard needs to be defined based on the marking method shown by the table below (Table 4-13), while recording all marking results on a specified record sheet.

**Table 4-13 Marking Method**

Evaluation target	Marking method
Working results	Mark after measuring the achievement completed after work.
Working procedures	Observe the behavior of the trainees working on training assignments. Record the results on a recording paper such as check sheet and mark their evaluation.
Working attitude	
Working time	Keep the time spent for work, or set deadlines and record the amount of overtime when it is past the dead line.

## 4.7 Implementation of Lessons

### 4.7.1 Motivation of trainees

When a training course is established, the VT instructors set the training objectives and the attainment objectives for their training course. Therefore, the VT instructors are able to be conscious of the relationship between the training objectives and the attainment objectives. Similarly, the VT instructors are able to be conscious of the relationship between work and the attainment objectives. However, it is difficult for the trainees to connect the training objectives, the attainment objectives, and work together.

For this reason, the VT instructors are required to motivate the trainees when opportunities arise during the training course. Motivation means more than merely encouraging the trainees to arouse their feelings of enthusiasm. Rather, it plays a role in connecting the training objectives, the attainment objectives, and the work.

In particular, motivation which is conducted at the beginning of the training course is significantly important. At this point, the trainees don't know about the job trade which is associated with their training. Therefore, the VT instructors need to explain in an easy-to-understand way what kind of work the trainees can do by acquiring the content of the training. Moreover, the VT instructor needs to explain as to what kind of problems will bother trainees with their work, if the trainees fail to acquire the content of the training. Additionally, excellent VT instructors also tell the trainees about what kinds of connection and the relationship that could exist between the attainment objectives of the present training course and those of other training courses.

In other words, the motivation stage conducted at the beginning of the training course does not finish in a couple of minutes. The VT instructors have to preserve enough time for the designing of the instruction plan and give lectures which all the trainees will be convinced.

To achieve this, the VT instructors start their preparation in the stage of lesson design. The VT instructors do careful research on job trades that are closely related to the training, clarifying relationship between the training objectives, the attainment objectives, and the work, while making an effort to be capable of describing this relationship in their own words.

At this time, the VT instructors assume what knowledge the trainees actually have beforehand, and they have to keep their descriptive lectures within the scope of the trainees' knowledge. Therefore, as needed, the VT instructors prepare necessary figures, video materials, or other complementary materials that supplement deficient knowledge of the trainees. If the knowledge status of the trainees is unclear, the VT instructors make every effort to understand by asking the previous VT instructor who trained the trainees before, or by observing the previous training session. It is also a good idea to check the career of the trainees. The more the assumption for background of the trainees become accurate, the more they can succeed in motivating the trainees.

Furthermore, a target analysis chart is useful when the VT instructors try to tell the trainees what kind of relationship and association actually exist between the attainment objectives of this training and those of other training courses. This chart indicates that the trainees can reach higher objectives when they have achieved all subordinate objectives. In other words, this chart clarifies the level of attainment objectives which the trainees will not be able to reach in the future unless they achieved the present attainment objectives in the current training course.

Actually, motivation is not conducted only at the beginning of the training course. The VT instructors conduct motivation at every milestone for each training item. However, this motivation does not take much time like the one conducted at the beginning of the training course. In this motivation session, the VT instructor speaks about the following points in a short time.

- Topics that make the trainees remind the motivation stage conducted at the beginning of the training course
- Connection between the previous training item and the succeeding training item
- Position of the current training topic for the training objectives and the attainment objectives

The VT instructors might explain about the points other than the above-mentioned things. This motivation is conducted in order for the trainees to keep memory of the relationship between the training content and work, and also to engage in training with future prospects.

Whether or not it was conducted at the beginning or at each milestone during the training course, the result of its success or failure will be reflected on the attitude of the trainees. Proper motivation that moves the trainees can really enhance the training effects. Therefore, this activity should not be neglected.



### 4.7.2 Easy-to-understand speech for trainees

The VT instructors must observe the following points on their speech during the training course. These are the basic of basics.

- Speak at a proper speed so that the trainees can easily catch up.
- Speak with proper volume so that all the trainees can listen.
- Avoid using non-related or unnecessary exclamation marks or sounds, such as “um...” or harrumphing.
- Avoid a chalk talk. Speak facing the trainees after finishing drawing or writing on the board.

This section also introduces how you should speak in order to give even more easy-to-understand explanations to the trainees.

First of all, the VT instructors must avoid speaking one-sidedly if they want to give an easy-to-understand explanation to the trainees. The VT instructors have to check the reactions of the trainees from time to time during their explanation.

This can be done by observing the trainees and their reactions. The VT instructors observe whether the trainees are nodding to them during their talk. Additionally, the VT instructors could also ask questions occasionally in order to confirm whether the trainees can understand what is explained. If the VT instructors’ speech is clear and understandable, many trainees are nodding or listening carefully while looking at VT instructor.

If there are many trainees who are not nodding or who are tilting their heads, it means that VT instructor speaks in a way which is difficult to understand for the trainees.

If this is the case, the causes listed below could be considered.

- The VT instructor is using technical term that is unfamiliar to the trainees.
- The trainees cannot imagine the scenes and situations brought out by the VT instructor due to lack of experience.
- The trainees do not understand the background or circumstances as the premise.
- The order of the topics mentioned by the VT instructor is not in chronological order.

Removing above causes lead the instructors to a practical speech which is easy-to-understand for the trainees.

An attempt to confirm the knowledge level of the trainees in advance can help the VT instructors understand whether the trainees know some particular technical term or whether they have experienced particular situations or circumstances. Section “4.7.1 Motivation of trainees” describes how the VT instructors can confirm the knowledge level of the trainees.

The background and conditions as premise for an explanation are frequently regarded as a matter of cause for the instructors. Therefore, VT instructors tend to omit giving the trainees necessary explanations about such information. The senior VT instructors are more frequently tend to omit giving necessary explanations. Caution should be exercised. For this reason, basic explanations should be consciously incorporated into the main topic of the lesson.

Chronological inconsistency in which they speak could cause confusion to the trainees. Therefore, the VT instructor needs to avoid speaking in an off-the-cuff way. Rather, they have to speak while being conscious of the chronological order by referring to the operation procedure.

As an example of the motivation, the section below shows a bad example and a good example regarding the way of speaking. Here, it is assumed that the trainees belong to the training course to acquire Internet technology. However the trainees do not have any basic knowledge of the internet since the training course has just started.

The next example shows a speech where the background and explanation of the situation are omitted and is difficult to understand for the trainees due to being outside and beyond the scope of their knowledge or understanding. Shaded portions are those significantly outside and beyond the scope of the trainees’ knowledge.

[Example of difficult-to-understand speech]

The Internet is connected by **TCP/IP**, and it is very important to know this fact. For example, you have experienced network trouble due to **congestion**, haven’t you? This might be due to problems existing in the **separation of segments**. By using knowledge learned through this lesson, let(s build a comfortable Internet environment.

If those individuals have related expertise and experience, the above speech is easy to understand. The VT instructors unintentionally speak in the way described above because they have expertise and these experience.

The following example is also about completely the same topic as above. However, words and expressions are changed based on consideration of the scope of trainees' knowledge. Furthermore, the background and conditions where the explanation are omitted in the previous example are also explained. Shaded portions are those with words changed and explanations added.

[Example of easy-to-understand speech]

It is very important to know that the internet is connected with unified technological specification and protocols called TCP/IP so as to use various electronic devices all over the world. For example, you may have experienced some trouble with a network, where it becomes quite slow and heavy. If this occurs frequently, there might be problems that originate with the network design. Learning TCP/IP enables you to understand how such a network should be designed. By using knowledge learned through this lesson, let's build a comfortable Internet environment.

As shown in these examples, the VT instructor have a tendency to unintentionally use technical term which is unfamiliar to the trainees or fail to explain the necessary background or conditions. Therefore, the VT instructor first needs to understand to what extent they can omit explanation and comments on specialized knowledge to the trainees. Additionally, they try to replace difficult technical term and terminology with other plain words and expressions, while adding necessary explanations about the background and conditions. If such replacement or addition of explanations is difficult, the VT instructors should prepare some supplemental materials including diagrams or video material.

It should be noted that when creating lesson plans, VT instructors can prevent incorporating difficult-to-understand speech. To do this, VT instructors have to prepare, create, and elaborate on a lesson plan in great detail. In other words, the instructors have to consider trainees' knowledge scope and lesson procedure which does not confuse the trainees during creating lesson plan.

Not only above difficult-to-understand speech, but the VT instructors sometime make trainees confuse. Whatever the case may be, the VT instructors must read the reactions of the trainees whether they understand or not. If not, the VT instructors need to trace the causes of why the trainees appear not to understand and they have to improve on what they find out.

## 4.8 Response to Difficulties of Trainees

As described in “(3) Response to various conditions of trainees” of section “2.3.3 Management items concerning rationality and efficiency toward objective of training”, the VT instructors are responsible for offering support for the trainees under conditions that could cause the trainees difficulty in sitting for a training. Support is offered through personal interviews conducted with individual trainees. Through personal interviews, the VT instructors advise each individual trainee on how they can cope with difficulty.

In many cases, VT targets the unemployed especially, whose base for living are unstable and fragile. Therefore, some trainees need to stop training due to economic reasons. The VT instructors give some advice after perceiving what measures or assistance can be made in order to support the base for living of the trainees during the training period.

Due to unstable base for living, the mental health of the trainees might deteriorate. If this is the case, the VT instructor needs to notice changes in the trainees as early as possible, and give them advice to receive special counseling services from specialists or medical institutions.

Additionally, it could result in human-relation problems or conflicts between the trainees. When this kind of situation arises, the VT instructors need to interview both parties in order to solve the problem.

The key to success in responding to the difficulties of the trainees to continue sitting for the trainings is that VT instructors detect such signs as early as possible. In some cases, when the trainee comes to the VT instructor for consultation, the relevant problem has already become too serious to solve. Therefore, the VT instructors must find out and respond to such problems while they are still quite small.

To find out such problems, being observant of all the trainees is an essential thing to do. Mainly, the VT instructors need to be observant regarding the following points.

- Changes in conditions of taking training, attendance, late arrival, and leaving early
- Changes in grades
- Changes in training motivation
- Changes in dress and grooming
- Changes in human relationships among the trainees
- Job-hunting conditions

There are so many reasons of trainee’s problems. If a certain trainee’s conditions deteriorate, such as attendance, late arrival, leaving early, grades, training motivation, or grooming, and if these causes seem to be not related to the training, there might be trouble in his/her home. If a trainee’s changes in attitudes are related to human relationships among the trainees, for example, the trainee appears to be isolated or other trainees ignore the trainee, trouble might arise. If a trainee’s job-hunting activities seem to be inactive, his/her mental health could deteriorate.

Observation can enable the VT instructors to detect such changes early, so that they can make necessary preventative measures and solve the trainee’s problem.

Now, there is one more important matter about the response to a difficult situation of the trainees to attend a training course. It is to make a systematic effort. In many cases, problems cannot be solved by only a single VT instructor.

For example, observation for early detection will be difficult in a system where the VT instructors take turns according to the training subject. This is because information regarding attendance, late arrival, and leaving early during the training period is separately managed by each individual VT instructor in charge of the training subject. Therefore, a systematic effort should be made in order to share such information in a horizontal manner. Additionally, coordination between counselors and staff members should be required to respond to mental health deterioration of the trainees.

Therefore, this response to difficult situation of the trainees to attend a training course cannot be done by a single VT instructor alone. All related staff members and VT instructors must cooperate together to make the necessary responses to such situations. A quick solution for a problem of trainees will become possible by making systematic and organizational efforts.