Effectiveness of Daily Living Abilities (DLA) as a Tool for Evaluating Vocational Competencies: study of Non-disabled Workers Aged 45 and Over

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A questionnaire survey was conducted on 28-55 items of daily living abilities (DLA) linked to 13 basic vocational competencies such as memory, learning, planning, judgement, muscular power and concentration covering a total of 505 non-disabled blue collar male workers aged 45 and over.

Results of the survey were as follows,
1. The 457 subjects were grouped into five groups ranging from normal to unsound groups according to the degree of DLA;
2. The reduction of DLA has directionality to two factors, memory and muscular power;
3. DLA provide clues for aging;
4. Among basic vocational competencies, muscular power showed the highest performance with a small standard deviation, while concentration scored low points with a large standard deviation (p<.05);
5. No age difference was found in planning ability, coordination, muscular power, physical tolerance, manual dexterity, and sense of equilibrium, while subjects aged 65 or over showed significantly low figures for learning ability, agility and concentration (p<.05);

Since the findings showed various characteristics of vocational competencies and the aging process precisely in blue collar workers aged 45 and over, we assumed that the DLA survey is one of the alternatives for evaluating workers vocational competencies.

(Key Words: Non-handicapped, Blue-collar workers aged 45 and over, Daily Living Abilities (DLA), Vocational competencies)

INTRODUCTION

A number of people aged 45 and over in the population of Japan shows a steady increase associated with such factors as prolonged average life expectancy and decrease in birth rate (17). With people leading a longer life and the aging of the society, more cooperation is needed between labor and the fields of health care, medical care and welfare.

As a part of such efforts, the Ministry of Labor has adopted various priority policies since 1985 including employment and competence development measures for workers aged 45 and over to assure stable employment and livelihood in the aging society.

In particular, the University of Polytechno-
measured by certain indicators.

The purpose of this report is to identify the characteristics of workers aged 45 and over based on DLA as one of the indicators, as well as to analyze and review the relation between DLA and vocational competencies through two surveys (2,3).

Basic studies in the field of occupational therapy are few with the exception of experimental studies (6, 7, 9). In particular, research on characteristics of vocational competencies covering aged people is rare in Japan (4, 5). Most of the references are in European and American (8, 12, 13, 14, 15, 16, 18, 20).

The results of the pilot survey and the second survey are useful as basic data on occupational therapy for the employment and continued employment of disabled people aged 45 and over. It is essential for a review of vocational rehabilitation of disabled people aged 45 and over to understand such points as aging and changes in vocational competencies in non-disabled people.

II. Subjects and Methods

1. Subjects

1) Subjects for the pilot survey (2) (Table 1)

The subjects of the first survey were 457 individuals (245 individuals from large scale and 212 individuals from medium scale firms) aged 43 through 62 employed by seven ordinary firms, comprising mainly workers engaged in machine design, processing, and assembly in the manufacturing industry.

Gender and age distribution of the subjects is shown in Table 1. Although the subjects of the survey should have been those 45 years old or over, they actually included 4.8% of those under 45.

The reason why the subjects of this survey were limited to workers in the manufacturing industry was only because too many occupational categories would threaten the acquisition of one cell necessary for the analysis of characteristcs.

2) Subjects for the second survey (3) (Table 2)

The subjects of the second survey were 48 non-disabled male workers aged 45 and over engaged in the manufacturing industry with the proviso that they share rather common vocational mental and physical functions. Basic attributes of the subjects are shown in Table 2. The 48 subjects of the survey were aged 45 through 67, averaging 55.6 years of age. Their average grip power was 41.4 kg, and together with stature, they came under the “average” category mentioned in the report by Kobayashi et al. (11).

Changes of occupation by the subjects varied with the individual from 0 to 4 times at the most. The jobs they are currently engaged in is design of compact machinery and equipment in two cases, processing in four cases, assembly in six, administration in three, machine operation in three, repair and maintenance in one, self-employed in 14 cases, agriculture in seven, and others in eight cases.

2. Methods (Table 3 and 4)

The pilot survey (2) and second survey (3) were conducted by a questionnaire entitled “Questionnaire on Work Process and Vocational Training Programs,” and questionnaires were mailed to the individuals involved.

Questionnaire sheets on DLA listing 55 items in total including the first 28 items (used for the pilot survey) are shown in Table 3. Each group of four to five items are related to each of 13 basic vocational competencies which were extracted based on prior research (1, 10, 19, 21). They are memory, learning ability, planning ability, adaptability, judgment, coordination, muscular power, agility, physical tolerance, concentration, audiovisual abilities, manual dexterity, and sense of equilibrium which are shown in Table 4.

When adding items, scenes and situations likely to exist or appear in daily life were enumerated and grouped according to the 13 basic

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Basic Attributes of Subject People (the pilot survey)</th>
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<tbody>
<tr>
<td>Subject people</td>
<td>457 persons</td>
</tr>
<tr>
<td>Sex</td>
<td>male 382 female 75</td>
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<tr>
<td>Age (old)</td>
<td>48.2 ± 3.2 (43-62)</td>
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<tr>
<th>Table 2</th>
<th>Basic Attributes of Subject People (the second survey)</th>
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<tbody>
<tr>
<td>Subject people</td>
<td>48 persons</td>
</tr>
<tr>
<td>Sex</td>
<td>male</td>
</tr>
<tr>
<td>Age (old)</td>
<td>55.6 ± 6.6 (45-67)</td>
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Table 3 Questionnaire Items on Daily Living Abilities (DLA)

1. Buttoning up a shirt or blouse.
2. Wringing a towel or floor cloth (mop).
3. Putting arms through the sleeves of coat or overcoat.
4. Opening and shutting a door by turning the knob.
5. Rolling up and putting away, or laying out the bedding.
6. Stretching yourself out to take something within your reach.
7. Going up the stairs of a railway station.
8. Jumping across a pool 1 meter wide.
9. Bending forward and tie your shoes with strings.
10. Swinging a golf club or tennis racket.
11. Feeling giddy when you suddenly turn back.
12. You don’t feel dizziness when you stand up suddenly.
13. You can keep standing in the train without hanging from a strap when the train is not so crowded.
14. Reading a newspaper or a book (using a pair of glasses).
15. Boning roast fish.
16. Can hear a telephone ringing while watching TV.
17. Can feel the favorite temperature of bath.
18. Sometimes forgetting a small thing.
19. Remembering interesting articles and programs in newspapers, magazines and TV programs.
20. Calculating the amount to pay mentally when you bought or eat something.
21. Can’t sleep off fatigue overnight.
22. Sleeping well.
23. Turning on and off gas by operating the main bulb.
24. Turning on and off water by operating the tap.
25. Turning the key kept in the door lock.
26. Pulling off a plug from the outlet just above the floor.
27. Opening and shutting a sliding door installed in places such as the entrance.
28. Opening and shutting drawers of a cabinet as high as your elbow containing clothing.
29. Peeling off the skin of an apple skillfully using a kitchen knife.
30. Being consulted by others.
31. Remembering the name of a person whom you have met.
32. Feeling awkward in your action.
33. Operating home electric appliances.
34. Determining what to do when involved in earthquake or disaster.
35. Do what you do in your daily life weighing well before doing.
36. Figuring out the method of memorizing in your own way when you intend to learn a new thing.
37. Feeling reluctant to use a new machine or equipment you have never used before.
38. Making similar mistakes repeatedly.
39. Sometimes hardly catching what others say.
40. Can cope well with heat and coldness.
41. Can shuffle a pack of cards dexterously.
42. Deliberating carefully before you address to something.
43. Being confident in the strength of your legs and loins.
44. Cutting your fingernails of both hands with scissors.
45. Listening intently what others tell to you.
46. Feeling tired after walking one hour or so.
47. Explaining contents of a newspaper or TV program.
48. Make a plan for travel.
49. Being upset when a stranger talks to you.
50. Feeling confused at a place where you visit for the first time.
51. Repairing inside of your house.
52. Attending gatherings of people.
53. Dodging your way through a crowded people on the street.
54. Can’t concentrate during work.
55. Can keep balance well standing with one leg.

Example of answers
1. easy to do. 1. seldom 1. exist
2. can do with a little difficulty. 2. occasionally 2. mostly
3. manage to do with difficulty. 3. sometimes 3. not many
4. can’t do. 4. often 4. none
vocational competencies. Adoption or rejection of items was done by agreement of the researchers/authors. There was a shortage of items in the first survey related to competencies such as learning, planning, adaptability, and judgment, which are psychosocial functions. Also, items regarding motor functions such as muscular power and sense of equilibrium, were added if considered too few in the second survey.

The answers to each item were classified into four grades from "easy to do" to "can not do" (see Table 3).

The first survey was conducted from February 1 to March 30, 1991. The second survey was conducted from February 20 to 27, 1992.

3. Methods of Analysis

1) Pilot survey (2)

Simple aggregation was performed based on collected questionnaires. In order to find diminishing factors of DLA, and to group the people aged 45 and over based on diminishing patterns, the answers to 28 items concerning DLA were analyzed by factor analysis, and then the results were subjected to cluster analysis.

2) Second survey (3) (Figure 1)

Simple aggregation was performed on collected questionnaires. Answers to items one through four in the example for DLA were given marks of 1-4, respectively, to weight them in relation to the 13 basic vocational competencies. Then they were collected and added by group.

Regarding the relation between DLA and the 13 basic vocational competencies, the upper three competencies among these basic vocational competencies were extracted for each of 55 items by the subjective viewpoint of the authors as shown in Figure 1: “competencies most closely related” “competencies rather closely related” and “competencies somewhat related.” Originally, DLA were compounded with various competencies, but only the upper three competencies were selected by agreement of the researchers. Later in the second survey, the answers of individual respondents were collected and totalled by each competency specified as “competencies most closely related” according to the above mentioned method, i.e. each answer by 48 subjects for the relevant items was collected and totalled, assigning 4 points for the answer “easy to do”, 3 points for “difficult but can do”, 2 points for “can manage to do”, 1 point for “can not do”, and 0 point for “no answer”.

III. Results

1) Performance of DLA (Figure 2)

The results of simple aggregation of data on performance concerning the 55 DLA items of 457 and 48 subjects are shown in Figure 2. Because of space limits in the figure, only item numbers are shown (see Table 3).

Among 55 items, only five items were considered “easy to do” by all subjects. These items were: wringing a towel in Item No. 2, putting arms through the sleeves of a coat in

<table>
<thead>
<tr>
<th>Table 4  13 Basic Vocational Competencies</th>
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<tbody>
<tr>
<td>1.  Memory</td>
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<tr>
<td>2.  Learning ability</td>
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<td>3.  Planning ability</td>
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<td>4.  Adaptability</td>
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<td>5.  Judgment</td>
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<td>6.  Coordination</td>
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<td>7.  Muscular power</td>
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<td>9.  Staying power</td>
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<td>10. Ability to concentrate</td>
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<td>11. Audio-visual ability</td>
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<td>12. Manual dexterity</td>
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<td>13. Sense of equilibrium</td>
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Effectiveness of Daily Living Abilities (DLA) as a Tool for Evaluating Vocational Competencies

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Number of: ● 8 12 6 27 18 18 11 9 7 11 3 10 15

VC *

1. Memory
2. Learning ability
3. Planning ability
4. Adaptability
5. Judgment
6. Coordination
7. Muscular power
8. Agility

9. Staying power
10. Ability to concentrate
11. Audio-visual ability
12. Manual dexterity
13. Sense of equilibrium

● competencies related most closely
○ competencies related considerably
△ competencies somewhat related

**Fig. 1** The relationship between DLA and the basic vocational competencies
Fig. 2  Performance of Daily Living Abilities of 505 people
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Table 5  Cluster Based on Daily Living Abilities

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Persons</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster-1</td>
<td>55 Persons</td>
<td>Pre-aged group having feeling uneasy with diminishing muscular power.</td>
</tr>
<tr>
<td>Cluster-2</td>
<td>10 Persons</td>
<td>Critical group that can't perform simple daily operation.</td>
</tr>
<tr>
<td>Cluster-3</td>
<td>44 Persons</td>
<td>Group that feels tired considerably and experiences severe forgetfulness.</td>
</tr>
<tr>
<td>Cluster-4</td>
<td>136 Persons</td>
<td>Pre-aged group feeling uneasy with diminishing memory.</td>
</tr>
<tr>
<td>Cluster-5</td>
<td>212 Persons</td>
<td>Normal group</td>
</tr>
</tbody>
</table>

(Number of total samples 457 persons)

Item No. 3, opening and shutting a door in Item No. 4, turning a water tap on and off in Item No. 24, and opening and shutting a sliding door in Item No. 27. The items considered by almost 90% of the subjects as "easy to do" included buttoning up a shirt in Item No. 26, and opening and closing drawers in Item No. 28. All of the above items were concerned with physical motion such as muscular power and manual dexterity were repeated frequently, and were under the physical tolerance.

Among the items in the second survey numbered 29 through 55, only a small number of people answered "easy to do," and many answered "difficult" or "manage to do," especially for items which seemed to be related to vocational life. The items were reluctance to use a new machine or equipment in Item No. 37, repeatedly making similar mistakes in Item No. 38, making plans for travel in Item No. 48, and confusion on the first visit to a place in Item No. 50. The answers ranged from "easy to do" to "cannot do" for other items such as shuffling a pack of cards in Item No. 41, and cutting finger nails in Item No. 44.

2) Cluster analysis of 457 subjects by DLA (Table 5)

Five persuasive clusters were extracted after applying the factor analysis. The results are shown in Table 5.

The factor axes extracted as a result of the factor analysis were the factor of muscular power (DLA items 5, 7, 10, and 27), of memory (DLA items 18, 19, and 20), and of fatigue and aging (DLA questions items 6, 8, 21, and 22).

Of the five groups extracted, the normal group (cluster 5) consisted of 212 individuals, accounting for 46.4% or about half of the subjects. Cluster 4 consisted of 136 individuals, showing they were grouped as a per-aged group afraid of memory failure, judging from the answers to the items for DLA and performance level. Next, cluster 3 consisted of 44 persons (a little less than 10%) and was found to constitute a class with both muscular power and memory diminished, considerable fatigue and serious forgetfulness. Cluster 2 was a group that was critical and found it difficult to perform simple daily living functions. Ten subjects who came under this cluster answered "difficult but..." to some DLA questions such as those in items 1, "buttoning up a shirt or blouse"; 3, "putting arms through the sleeves of a coat"; 4, "opening and closing a door"; and 28, "opening drawers". These people could be classified as a rather singular, unsound group. Fifty five subjects were in cluster 1, a group with problems of diminishing muscular power.

3) DLA and job performance of 457 subjects in five clusters

The question was asked concerning what kind of vocational competencies diminished with aging. The resulting answers are shown in Figure 3 by five clusters of DLA.

As a result of analysis, it was found that the diminishing factors of DLA often appeared in diminishing job performance. As a specific example, subjects who "can't stand without hanging from a strap" as in DLA item No. 13, evaluated their agility and physical tolerance as low.

As a whole, subjects in cluster 4 with consistent concern for diminishing memory answered at higher rates than those in other clusters to items concerning competencies for intellectual professions including memory and learning competency, while those in cluster 1 with concern for diminishing muscular power showed deeper awareness of diminishing phys-
Fig. 3 Competencies as Diminishing Factors of job Performance by Cluster Based on DLA.

Fig. 4 Basic Vocational Competencies Based on Daily Living Abilities
ichanical tolerance or agility. Subjects in cluster 2 who were called the unsound group were characterized by answers that the diminishing factors of vocational competencies were coordination and physical tolerance.

Individuals in cluster 3, the pre-aged group feeling considerable fatigue or experiencing serious forgetfulness showed in their answers stronger awareness of a diminishing sense of balance and audiovisual abilities, memory, and judgment. There was almost no one in any of the clusters that chose planning ability as a factor of diminishing vocational competencies. The normal group in cluster 5 chose memory, judgment, and concentration as the main diminishing factors.

4) Relation between DLA and basic vocational competencies (Figure 4)

Next, DLA of 48 subjects were collected and totalled in relation to the 13 basic vocational competencies. The results are shown in Figure 4.

Among 13 basic vocational competencies, those with higher performance points based on the answers were in the order of muscular power, learning abilities, memory, and agility with small standard deviations, while adaptability and concentration received low points, and it was found the standard deviation was showing large individual variations.

Among these competencies, significant variation from the average points of 13 competencies (p<.05 in the t test) was found in muscular power and concentration, i.e., in 48 subjects, the highest competency was muscular power and the lowest was concentration.

5) Comparison of basic vocational competencies by generations viewed from DLA (Figure 5)

Figure 5 showed the performance of DLA of the subjects pigeonholed in relation to the 13 basic vocational competencies, and grouped by three age brackets. The three brackets are groups of people aged 45 to 54, 55 to 64, and 65 or older.

Most of the answers given by each age

![Diagram showing vocational competencies based on daily living abilities by age.](image-url)
bracket were identical, showing high points regarding muscular power and physical tolerance, although points were low and showed no difference by age.

On the other hand, the competencies that showed different trends in performance by age bracket were memory, learning ability, adaptability, judgment, agility, and concentration. Regarding these six competencies, the chi square test was applied to the three age brackets and answer levels, and a significant difference (p<.05) was found in learning ability, agility, and concentration. Generally, competency points could be said to be high in the 45 to 54 group, and low in the 65 or older group. Concentration was the highest in the 55 to 64 group.

IV. Discussion

Since the survey was performed by questionnaires sent to workers aged 45 and over, the respondents might resent to questions about their vocational competencies. Therefore, the survey was undertaken assuming that DLA are one of the alternatives of vocational competencies of the subject himself. As a result, the authors could confirm that the characteristics of vocational competencies can be measured according to the level of performance in various DLA.

The results of cluster analysis grouped the subjects according to the diminishing factors of DLA and the degree of diminishing, and moreover, it was found that the diminishing factors had two way directionality, i.e., the factors tended to memory and muscular power. During this process, a group, which was considered an unsound group, consisting of individuals who could not deal with daily life, was extracted although it included only a small number of subjects. This is a result that best answers the purpose of this research. By deeper analysis of characteristics of such a singular group, valuable suggestions are presented for assisting the employment of disabled people who are the main subjects of occupational therapy. For example, some individuals in this singular group can, despite problems in physical tolerance or coordination, continue vocational life. In such a case, these individuals may freely use memory or judgment abilities which have not diminished so much. There is no problem of diminishing physical tolerance if the length of working hours is taken into consideration.

It has become clear that this supposedly unsound group can be detected to a certain degree in normal firms through DLA. This is of great significance. A survey of DLA can be conducted more easily and expeditiously than an ordinary physical examination. Earlier detection of aging signs by examining DLA and proper consideration and measures for individuals in the unsound group will promote prevention of diseases or disability, and continued employment. On the other hand, these measures will prod those concerned to become aware of health care.

Items extracted as an indicators of aging from the results of the survey on DLA were short movements repeated frequently in daily life, i.e., "buttoning a shirt or blouse," "wringing a towel," opening and closing a door," "-turning gas on and off," "turning water on and off," "opening and closing a sliding door," and "opening and closing drawers of a cabinet." These findings were supported by S. Isernhagen (1991, 20), who noted that "we do not decrease our use of hands as we age as much as we decrease use of our back and lower extremities." People who can not undertake even these activities seem to show rather advanced senility.

It was also confirmed in the pilot survey that consciousness of diminishing vocational competencies changed as the performance level of DLA changed, and this fact suggests the development of training programs which will be the subject of future research. For example, as seen in the sample of answers to DLA question item 13, there appeared to be a trend in which the subjects attributed their diminishing job performance to the areas where their DLA had diminished. The difference of DLA among the above subjects who answered in this way seems to govern the directionality and method of vocational competency development.

Subjects in cluster 2 which is an unsound group are characterized by their reference to coordination or physical tolerance as diminishing factors of vocational competencies, and this is considered as representing self-consciousness of hardships in vocational life itself. However, the statement cannot be determined because it was induced from subjective answers of the
respondent in this survey.

No subjects in any cluster referred to planning ability as a diminishing factor, but this is considered to be due to the fact that the subjects of this survey were field workers including those in the manufacturing and processing industries, and that they were inclined to be unaware of competencies which were not necessary for them as a diminishing factor. The normal group of cluster 5 should be divided into two pre-aged groups later: cluster 1, diminishing muscular power class, and cluster 4, diminishing memory class. Further, a part of both diminishing muscular power and memory is considered to shift to cluster 3, "severe fatigue" or "seriously forgetful" class.

Regarding muscular power, its quick reaction element and physical tolerance were not always clearly differentiated with respect to both DLA and vocational competencies. Rather, in the present research, 13 vocational competencies were presumed to have linking functions to one another, but the authors hope to report this separately.

In the simply aggregated answers for 55 items of DLA of the subjects those for items No.1 through 28 were almost the same in performance as those in the pilot research. This fact seems to have reconfirmed that "DLA will diminish in a certain order," and that some abilities will start diminishing from the age of 40, while some will be maintained to an advanced age.

In short, DLA related to items such as physical tolerance and adaptability will start diminishing at the age of 40, while manual dexterity repeated frequently in daily life such as buttoning up or tuning water taps will be maintained even until the advanced age of 65 or over. These findings will give useful suggestions in the study of working life assistance programs for the disabled aged 45 and over, resulting in a demonstration of the effectiveness of function maintaining effects in currently prevailing occupational therapy in general.

The results of an analysis of 55 items of DLA in relation to 13 basic vocational competencies reflect the characteristics of workers in the manufacturing industry aged 45 and over to a considerable degree although the answers for the items were subjective. It appears that high points in muscular power, physical tolerance, manual dexterity, and sense of equilibrium regardless of the age of the subjects resulted from the fact that they were all employed as blue collar workers, especially in the manufacturing industry where physical labor is required and their vocational life was reflected in their DLA. Nygard (1988, 18) reported that exercise and activity not only slow the aging process of muscles, but in some cases can reverse it. Here again, it will be demonstrated that abilities contiguously used are maintained rather well. It is, however, not certain whether the abilities are maintained because of continued use, or these well-maintained abilities make it possible for them to continue to work. In either case, if the abilities frequently used in daily life can be self-evaluated rather precisely, in those abilities is found the effectiveness of the DLA survey. It is also possible to understand self-vocational competencies and signs of aging, and take proper measures if appropriate questions applicable to all subjects can be selected.

In the comparative study by age group, adaptability and concentration did not always diminish with aging. This is because the answers of some individuals in the two age groups of 45 to 54 and 55 to 64 with rather marked diminishing abilities affected the results of the overall answers. Since these individuals were able to work even with marked diminishing abilities, this shows the abilities required in the workplace are not usually the maximum competencies.

The high score for sense of equilibrium in the answers of all subjects was a refuting of the popular saying that "aging starts in legs and loins," and the report concerning the values of physical strength tests by age group by Kobayashi et al. (1, 11). Also, S. Isernhanen (1991, 20) suggested that balance loss will not necessarily put workers in danger at the usual retirement age, but it must be considered in combination with wok. The result entails some doubts: this high score might have resulted from good maintenance of abilities because the subjects in this survey have many chances to move their bodies in daily life such as commuting on foot or by bicycle; it might be due to subjective answers, or in other words, they were not aware of actual diminishing as a result of adapting themselves in their own way; it might be due to inadequate questions asked.
The authors intend to report these points together with the results of objective measurements undertaken in the future.

Other problems include the fact that, in the DLA questionnaire covering 55 items including those added in the second survey, the same number of items did not always come under each 13 basic vocational competencies, and in the same table, the expressions used for the rating of each items did not represent uniform levels.

In the future, it will be necessary for us to establish more appropriate items and to study the nomologic nature of terminology representing the level of rating in the questions posed.

Conclusion

Competencies of people aged 45 and over reflect their lifelong daily and vocational activities. Therefore, it is very important to understand these compound competencies properly. Moreover, in their measurement, the method must impose the minimum load on the people involved and be accepted without psychological resistance. Most European and American reports (8, 15, 18, 20) were based on experimental research. From such a viewpoint, it is safe to say that the authors' attempt to understand vocational competencies of the subjects through their DLA has been able to achieve highly accurate results.

It is useful for occupational therapists to know that the signs of aging can be detected, and to confirm that the vocational competencies are estimated to a certain degree by understanding the DLA of the subjects.

In the future, the authors hope to continue to verify that the hypothesis established in these studies applied to the disabled as well as to reexamine DLA items which will enable us to understand the vocational competencies of the subjects more precisely.

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