ABSTRACT

The expanded planting of artificial forests has been facilitated in forests in Japan in response to the requests from Japanese people, who were in need of wood materials during the period of the economic growth, and for public use of the forests. However, even though Japan currently has a larger volume of artificial forests than ever before, the forests are not utilized due to a contradictory heavy dependence on imported wood.

In order to pass the forests and their public functions down to the following generations and to realize “sustainable development,” there is a need for human resources which can look for the root of problems with multidimensional perspectives and can innovate regional societies.

The purpose of the study is to focus on the competency growth of students participating in forest volunteer activities as a possible means for such human resource development and to consider the educational effectiveness, by measuring their development. For that purpose, we measured the growth of students’ competencies through volunteer forest activities, by the Fundamental Competencies for Working Persons (FCWP), based on the data of 20 students who participated in forest volunteer activities in Niimi City, Okayama Prefecture. The growth rate of students’ competencies through forest volunteer activities was characteristically seen in their Ability to control stress, Creativity, Ability to influence, and Ability to grasp situations, which was judged by self-evaluation sheets before and after a 2-week activity.

Principal components are analyzed to verify the factors for the above results and the factors of achievement and activity contents for the forest volunteer has positively influenced competency growth.

Keyword: forest education, forest volunteer activities, fundamental competencies for working persons (FCWP), higher education

INTRODUCTION

Background and Purpose

The coexistence of people and forests in Japan has occurred since the Jomon Period, about 10,000 years ago, and after a long period of time, a local forest called the Satoyama formed, bringing about Japanese traditions and culture, a sense of awe toward nature, seasonal landscapes and further, abundant resources such as lush vegetation and animals.

The expanded planting of artificial forests has been facilitated in forests in Japan in response to the requests from Japanese people, who were in need of wood materials during the period of the economic growth, and for public use of the forests. However, even though Japan currently has a larger volume of artificial forests than ever before, the forests are not utilized due to a contradictory heavy dependence on imported wood.

Along with changing lifestyles, direct connections between people and forests have reduced over time and what people expect of the forests has drastically changed. Furthermore, the shortage of forestry carriers has also become serious, and the communities of hilly and mountainous areas,
where forests and their public interests have been protected, are suffering attrition due to the effects of depopulation.

Since the beginning of the 21st century, one of the expected roles of forests is as a field of education, and various experiential activities are provided in the forests. It isn’t unusual for urban residents to join forest volunteer activities on the weekends (Oishi and Inoue, 2015). Yamamoto’s (2007) definition of the educational significance of forest volunteer activities is that they positively influence the societies in hilly and mountainous areas and their forests through their activity of “action and cooperation,” and that they serve as an education to develop human resources capable of creating a new forest management system with the participation of citizens. In a broader sense, such an education can be seen as a method of developing human resources that can regenerate and lead a regional community protecting “local commons” (Okuda and Inoue, 2013).

In order to pass the forests and their public functions down to the following generations, and to realize “sustainable development” and “a sustainable society,” there is a need for human resources who can look for the root of problems with multidimensional perspectives and can innovate regional societies. Therefore, the purpose of the study is to focus on the competency growth of students participating in forest volunteer activities as a possible means of developing human resources and to consider the educational effectiveness by measuring their development. Some previous studies have suggested ways to induce spontaneous motivation from the achievement of forest volunteers (Aoyagi and Sato, 2007), the educational competence and effect of teaching staff (Aoyagi and Sato, 2008), and the psychological impact of forest activities (Ichihara, 2008). However, the development of human competencies of forest education participants has never been studied, and as Hiyane (2001) pointed out, the quantitative research on educational effectiveness was a task on forest education.

Forest Education and Forest Volunteer Activities

Forest education can be divided into two parts: education of “natural science” on the very existence of forestry and education of “social science” about events related to forests (Sekioka, 1998), and Oishi and Inoue (2014) defines “education on forests including forestry education and forest environmental education” as “forest education,” which helps participants to know the forest as a cyclic resource, while cultivating skills and attitudes related to the forest, as well as sensitivity, sociality and problem-finding skills, through the direct experience in the forest, and which aims at nurturing human resources who are responsible for society as a future leader of society. Here, forest education is proposed not as specialized education but as a widely needed education for the general public.

Yamamoto (2009) mentions that forest volunteer activities are expected to develop human resources who can protect and manage regional resources in natural/social scientific experiences through exchanges with people in the community and forestry management work.

Forest Volunteer Activities by University Students

Recently, educational activities have been frequently carried out utilizing regional issues and problems or regional resources in higher education. For instance, “Program for Promoting Inter-University Collaborative Education” and “COC: Promotion of the Center of Community” by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and “Systematic Fundamentals for Education and Evaluation System Development Project” by the Ministry of Economy, Trade and Industry (METI) (Hamana, 2010). In this way, there are many cases where forests are utilized as resources for regional activities.

Such education styles are introduced with the expectation of nurturing the next generation’s regional leaders through experiences by problem-based-learning (PBL) for training the citizenship and leadership of university students. It has become popular together with attempts to verify the educational effect from participant’s ability growth, from the viewpoint of university social responsibility (USR) and substantiation of university education.

The purpose of this research is to verify educational effects from the viewpoint of university students’ capacity growth. If the effectiveness of forest education is shown by comparison with other fields and educational programs, forest education can be promoted to meet the needs for human resources in regional communities.

**METHOD**

In this research, the growth of the forest volunteers is evaluated using “self-evaluation sheets” to analyze the competency growth of university students’ Fundamental Competencies for Working Persons (FCWS) (Fig. 1) (METI, 2008) by Hiroshima University of Economics (Hiroshima City, Hiroshima Prefecture, Japan). The university was selected in METI’s “Systematic Fundamentals for Education and Evaluation System Development Project in 2009” and has been participating in forest volunteer activities dealt with in this paper, using self-evaluation sheets to measure competency growth. This research and analysis method based on these self-evaluation sheets is summarized in Fig. 2.

**Method of Measurement of Competency Growth of University Students**

First of all, for measuring the competency growth of university students, a questionnaire survey is conducted on the grade, faculty/department, motivation for participation, etc., in the forest volunteer activities (Table 1).

Then, based on the Self-evaluation Rubric (Fig. 3) ranging from “level 0” to “level 3”, students are asked to evaluate and fill out the preliminary evaluation cells on the self-
Ex post self-evaluation ($x$) are verified from the relationship analysis of the self-evaluation levels and growth rate by preliminary evaluation and ex post evaluation regarding FCWS. In addition, to verify the characteristics of capacity growth depending on participant attributes, the correlation ratio ($\eta^2$) is judged preliminarily for students about their gender and university, participation style and days, repeat experience and times, motivation, understanding of the current situation of forests and forestry, the purpose of forest volunteers, and expected activity and growth values (where $\eta^2 \leq 0.10$ is regarded as no correlation). Next, principal component analysis is performed based on the growth values. The magnitude of the contribution ratio is taken as the influence of competency growth, and the factor name is specified for the first and principal component 2s from the individuality of each principal component loading. Coefficient of variance plots is prepared from the first and principal component 2 of forest volunteers (university students) and the educational effect is considered from the characteristics of competency growth.

Questionnaire Survey on Activities of Local Stakeholders
Forest volunteer activities cannot be carried out without the understanding and cooperation of people in the local areas. Therefore, a questionnaire survey is conducted for the local stakeholders, and the motivation to support the activities is examined, such as expecting their attributes and forest volunteer activities. The questionnaire items are shown in Table 3.

Research Subjects
The subjects of this research are 20 students from four universities who participated in “Forest Volunteer Activity in
Table 1 Questionnaire survey for university students

Q1. Please answer about yourself.
Question Items (Written Questionnaire): Name/Gender/University/Faculty/Department/Motive of participation (5-option multiple-choice) Answer items: Curricular activity/Extracurricular activity/Extracurricular Activity without curricular/Individual participation

Q2. Please answer about Participation Situation?
1) Participation Days (Written Questionnaire)
2) Participation record (Yes or No and Record Times)

Q3. Why did you come to volunteer activities? (15-option multiple-choice)
Answer items: Interested in forestry worker/Interested in environmental conservation/Interested in volunteer activities and social contribution activities/Interested in “I-turn: moving to the countryside” and “U-turn: return to their hometowns”/Interested in Community planning and the problems of local communities/As a learning of specialty or major/Interested in the management of volunteer activities and projects in local areas/For future dreams and goals (Career formation, looking for a job)/Self-growth (Acquire skills, Learning-Awareness)
A encounter of university students/A encounter of local peoples (industry-academia-government collaboration)/Recommendation by friends and seniors/Recommendation by teacher and administrator/Recommendation by local people/Others (Free Written Questionnaire)

Q4. Please answer about forest volunteer activities?
1) Do you understand about problems and situation of local areas? (5-option multiple-choice)
Answer items: Extremely well/Very well/Moderately well/Slightly well/Not at all well
2) Do you understand about problems and situation of local areas? (5-option multiple-choice) Answer items: Extremely well/Very well/Moderately well/Slightly well/Not at all well
3) What activities do you expect and look forward to? (7-option multiple-choice)
Answer items: Environmental conservation activities (thinning, pruning, carrying)/Group accommodation activities/Local event and festival/Welcome party/Make a study tour of lumber market/Briefing session

Table 2 Self-evaluation sheet for university student

| Fundamental Competencies for Working Persons (FCWP: 3 Competencies/12 Competency Factors) | Pre LEVEL | Target LEVEL | Ex-post LEVEL | What you achieved? | What not achieved? |
|-----------------------------------------------|----------|--------------|---------------|-------------------|-------------------|
| Initiative                                   | Ability to initiate things proactively | | | | |
| Ability to influence                          | Ability to influence and involve others | | | | |
| Execution skill                               | Ability to set goals and execute with conviction | | | | |
| Ability to detect issues                      | Ability to analyze status quo and clarify issues | | | | |
| Planning skill                                | Ability to clarify procedures to solve issues and prepare | | | | |
| Creativity                                    | Ability to create new values | | | | |

Fig. 3 Self-evaluation rubric of FCWP.
cial forests in Niimi City with young people such as university students. This activity was started by Waseda University Hirayama Ikuo Memorial Volunteer Center (WAVOC) in 2003, and developed the movement for saving nature in cooperation with schools from across the country, and this activity is part of that. In addition, WAVOC conducts inter-college activities that are open to students of other universities, so that there are expected educational effects, such as involvement with diverse students and learning leadership on activities. Therefore, diverse college students who join this movement gather for forest volunteer activities. These college students experience the thinning work while living together for two weeks and receiving guidance by local foresters, as shown in Table 4 activity contents. Additionally, the coordinator is an expert in the field of forestry and instructs the activities and students’ life.

Table 3  Questionnaire survey for local people

Q1. Please answer yourself.
  Question Items (Written Questionnaire): Name/Gender/Age

Q2. What are the issues and problems in local area? (Written Questionnaire)

Q3. How do you want to change your local area?

Q4. What do you expect? (Written Questionnaire)
  (1) Expect to university students
  (2) Expect to City hall.
  (3) Expect to local people

Q5. How satisfied do you feel about university students?
  Answer items: Extremely well/Very well/Moderately well/Slightly well/Not at all well

Q6. Did the students grow up?
  Answer items: Extremely well/Very well/Moderately well/Slightly well/Not at all well

Q7. What do you think university students can learn through the forest volunteer activities? (Written Questionnaire)

Q8. Please answer about forest volunteer activities?
  (1) Do you understand about problems and situation of local areas? (5-option multiple-choice)
    Answer items: Extremely well/Very well/Moderately well/Slightly well/Not at all well
  (2) Do you understand about problems and situation of local areas? (5-option multiple-choice) Answer items: Extremely well/Very well/Moderately well/Slightly well/Not at all well
  (3) What activities do you expect and look forward to? (7-option multiple-choice)
    Answer items: Environmental conservation activities (thinning, pruning, carrying)/Group accommodation activities/Local event and festival/Welcome party/Make a study tour of lumber market/Briefing session

Q9. Which competency of student do you think grew best?

Q10. Any other comments or suggestions? (Written Questionnaire)

Niimi, Okayama Prefecture in September 2015 (Fig. 4), where a questionnaire survey was carried out to gather data by using the self-evaluation sheet based on FCWP.

The forest situation in Okayama Prefecture Niimi city (FY 2015) is as follows: a forest area of 79,327 ha is occupied by private forest (59,292 ha), and the forest area ratio is approximately 87%. The artificial forest accounts for approximately 59% of the total forest area, and most of it consists of Japanese cedar and Japanese cypress (94%). However, due to sluggish lumber prices, the declining number of forestry workers and an aging of population, the implementation of forest management in the city becomes more difficult year by year, and the number of artificial forests urgently needing silviculture, such as thinning, is increasing.

In an effort to solve the problem, “Forest Volunteer Activities” have been implemented to create healthy artifi-
Table 4 Forest volunteer activity contents

| Day  | Activity Contents                                      |
|------|-------------------------------------------------------|
| 9/3  | Thu Set up day                                        |
| 9/4  | Fri Orientation, Thinning operation                   |
| 9/5  | Sat Thinning, Pruning, Carrying operation, Welcome party |
| 9/6  | Sun Meeting etc. (☆Weather: Rainy)                    |
| 9/7  | Mon Meeting etc. (☆Weather: Rainy)                    |
| 9/8  | Tue Thinning operation                                |
| 9/9  | Wed Meeting (☆Weather: Rainy)                         |
| 9/10 | Thu Thinning, Pruning, Carrying operation, Machinery maintenance |
| 9/11 | Fri Thinning, Pruning, Carrying operation etc.         |
| 9/12 | Sat Thinning, Pruning, Carrying operation etc.         |
| 9/13 | Sun Meet-and-Greet at local event                     |
| 9/14 | Mon Study tour of Lumber market                       |
| 9/15 | Tue Thinning, Pruning, Carrying operation etc.         |
| 9/16 | Wed Thinning, Pruning, Carrying operation etc.         |
| 9/17 | Thu Thinning, Pruning, Carrying operation, Wrap up session, Farewell party |
| 9/18 | Fri Breakup                                            |

In this study, a questionnaire survey is conducted from stakeholders supporting these forest volunteer activities.

RESULTS

Preliminary Analysis of Correlation Ratio (η²) and Participant Attributes

Of the approximately 30 people who participated in the forest volunteer activities, 20 persons completed the self-evaluation sheet in advance (Table 5), and the breakdown of the questionnaire survey is 7 males and 13 females, including 3 students from the Faculty of Bioresources from Mie University, 11 students from department of nursing from Niimi College, and 6 students from department of economics from Hiroshima University of Economics. As to their grades, there was 1 first grade student, 8 second grade students, and 2 fourth grade students, and the approach of participation includes 6 co-curricular activities, 11 extracurricular activities without co-curricular, 2 individual participations and 1 no answer. Most participants of the extracurricular activities were from Niimi College, as it has dispensation that allows students to earn credits if students participate as volunteers (extracurricular activities). Other participants participated as part of their club activities and project activities.

This activity is held for two weeks, twice a year in the spring and summer, and it has occurred for 12 years since 2004. Participants are free to choose the duration of participation according to individual circumstances. This time, there were 12 who participated for the full 2 weeks, 5 who participated for 1 week or more and less than 2 weeks, and 3 who participated for less than 1 week. There were 9 repeaters and 11 new participants, with the breakdown of repeat count being 2 participants had come 2 times, 5 participants who came 3 times, and 1 participant who came 5 times.

The most popular motivation for participation among them was “self-growth” with 18 people, and then “interested in volunteer activities and social contribution activities,” 17 people, followed by “meeting and social connection with university students,” 16 people. As shown by these motivations for participation, most participants “moderately well” understood the forest and forest industry's current situation, and more than half of the participants “moderately well” or less understood the purpose of forest volunteer activities. On the other hand, many described “conservation activities” as “expected activities”.

To examine the relation between these results of the questionnaire and the ex post self-evaluation by students, Table 6 shows the results of the preliminary analysis of the correlation ratio using MS-Excel. Among them, the correlation strongly appeared in the depth of understanding of the purpose (0.254), among the 12 capacity elements. There, the strong correlation ratio was found in all the elements other than “ability to grasp situations” and “ability to apply rules and regulations,” and specifically, the correlation was strong in “ability to control stress (0.513), “creativity (0.442)” and “planning skill (0.450)” among the 12 elements.

Analysis of Growth in the 12 Capacity Elements

Figure 5 shows a graph of pre/ex post self-evaluation and the growth rate of 12 competency factors of the 20 participants who submitted the self-evaluation sheet. The overall average growth rate of the 12 competencies from the preliminary evaluation to the ex-post evaluation was 177%. Growth was seen in all the competencies elements, and especially, the highest growth rate was 280% in “ability to influence,” followed by “creativity” 220%, and “ability to grasp situations and to detect issues” 200%, “Ability to grasp situations” 200%.

Result of Principal Component Analysis

Figure 6 shows the loadings of the principal component 1, which has been calculated by principal component analysis, based on the growth value of forest volunteer activities. Excel Statistics 2015 was used for the principal component analysis. The variance for principal component 1 was largest with a contribution of 55.90%. This component is representative of 12 variates. This amount of loadings has all positive values, and the competencies had increased overall. Some differences are seen in the loadings of competencies, but all of the competencies have a positive value.

Next, the contribution ratio for principal component 2 was 10.75% (cumulative contribution was 66.65%), this coefficient of the principal component loadings can largely be divided into plus and minus. Characteristics are seen in “ability to apply rules and regulations,” “flexibility,” the “ability to listen closely and carefully” in the plus value, and a minus value in “ability to influence,” “creativity” and “ability to detect issues.”

Result of Questionnaire Survey for Local Stakeholders

Table 7 shows the results of the questionnaire survey for...
### Table 5 Result of survey for university students

| Gender          | Variable | n | %  |
|-----------------|----------|---|----|
| male            | 7        |   | 35%|
| female          | 13       |   | 65%|

| Total           | 20       |   | 100%|

| Participation Days | Variable   | n | %  |
|--------------------|-------------|---|----|
| 1 day ~ 6 days     | 3           |   | 15%|
| 7 day ~ 14 days    | 17          |   | 85%|

| Total             | 20         |   | 100%|

| Understand about problems and situation | Variable | n | %  |
|----------------------------------------|----------|---|----|
| Extremely well                         | 0        |   | 0% |
| Very well                              | 2        |   | 10%|
| Moderately well                        | 12       |   | 60%|
| Slightly well                          | 5        |   | 25%|
| Not at all well                        | 0        |   | 0% |
| No answer                              | 1        |   | 5% |

| Total                                    | 20        |   | 100%|

| Understand about Purpose and Goal        | Variable   | n | %  |
|------------------------------------------|-------------|---|----|
| Extremely well                           | 1           |   | 5% |
| Very well                                | 8           |   | 40%|
| Moderately well                          | 6           |   | 30%|
| Slightly well                            | 4           |   | 20%|
| Not at all well                          | 0           |   | 0% |
| No answer                                | 1           |   | 5% |

| Total                                    | 20        |   | 100%|

| Motive of participation                 | Variable   | n | %  |
|------------------------------------------|-------------|---|----|
| Curricular                              | 0           |   | 0% |
| Extracurricular                         | 6           |   | 30%|
| Extracurricular without curricular      | 11          |   | 55%|
| Individual                              | 2           |   | 10%|
| No Answer                                | 1           |   | 5% |

| Total                                    | 20        |   | 100%|

| Expect Contents                          | Variable   | n | %  |
|------------------------------------------|-------------|---|----|
| Environmental conservation activities    | 19          |   | 22%|
| Group accommodation activities           | 15          |   | 18%|
| Local event and festival                 | 9           |   | 11%|
| Welcome party                            | 11          |   | 13%|
| Make a study tour of lumber market       | 12          |   | 14%|
| Farewell party                           | 12          |   | 14%|
| Briefing session                         | 7           |   | 8% |
| Another                                  | 0           |   | 0% |

| Total                                    | 85        |   | 100%|

| Participations Motivation                | Variable   | n | %  |
|------------------------------------------|-------------|---|----|
| Interested in forestry worker            | 3           |   | 3% |
| Interested in environmental conservation | 6           |   | 6% |
| Interested in volunteer activities and social contribution activities | 17 | 16% |
| Interested in "T-turn: moving to the countryside" and "U-turn: return to their hometowns" | 1 | 1% |
| Interested in Community planning and the problems of local communities | 6 | 6% |
| As a learning of specialty or major      | 1           |   | 1% |
| Interested in the management of volunteer activities and projects in local areas | 8 | 7% |
| For future dreams and goals (Career formation, Looking for a job) | 5 | 5% |
| Self-growth (Acquire skills, Learning-Awareness) | 18 | 17% |
| A encounter of university students       | 16          |   | 15%|
| A encounter of local peoples (Industry-academia-government collaboration) | 13 | 12% |
| Recommendation by friends and senior students | 11 | 10% |
| Recommendation by teacher and administrator | 2   | 2% |
| Recommendation by local people           | 0           |   | 0% |
| Another                                  | 0           |   | 0% |

| Total                                    | 107        |   | 100%|
| Items                          | Initiative | Ability to influence | Execution skill | Ability to detect issues | Planning skill | Creativity | Ability to deliver messages | Ability to listen closely and carefully | Flexibility | Ability to grasp situations | Ability to apply rules and regulations | Ability to control stress | AVG  |
|-------------------------------|------------|---------------------|----------------|--------------------------|---------------|------------|-----------------------------|-------------------------------------|-------------|---------------------------|--------------------------------------|--------------------------|-------|
| Gender                        | 0.004      | 0.023               | 0.017          | 0.002                    | 0.034         | 0.006      | 0.048                       | 0.002                               | 0.254       | 0.010                     | 0.000                               | 0.018                    | 0.035 |
| Organization                  | 0.111*     | 0.043               | 0.173*         | 0.066                    | 0.072         | 0.104*     | 0.324*                      | 0.052                               | 0.356*       | 0.159*                    | 0.121*                               | 0.039                    | 0.135*|
| Motive of participation       | 0.073      | 0.047               | 0.057          | 0.038                    | 0.080         | 0.059      | 0.074                       | 0.103*                               | 0.064       | 0.048                     | 0.066                               | 0.086                    | 0.066 |
| Participation Days            | 0.116*     | 0.022               | 0.213*         | 0.208*                   | 0.126*        | 0.100*     | 0.227*                      | 0.115*                               | 0.249*       | 0.052                     | 0.042                               | 0.017                    | 0.124*|
| Participation times           | 0.171*     | 0.143*              | 0.464*         | 0.250*                   | 0.500*        | 0.100*     | 0.175*                      | 0.325*                               | 0.175*       | 0.100*                    | 0.297*                               | 0.019                    | 0.233*|
| Participation record          | 0.347*     | 0.064               | 0.122*         | 0.056                    | 0.065         | 0.100*     | 0.010                       | 0.254*                               | 0.037       | 0.108*                    | 0.063                               | 0.190*                   | 0.115*|
| Understand about problems and situation | 0.227* | 0.032               | 0.080          | 0.079                    | 0.080         | 0.032      | 0.215*                      | 0.036                               | 0.072       | 0.024                     | 0.104*                               | 0.156*                   | 0.095 |
| Understand about Purpose and Goal | 0.208* | 0.384*              | 0.208*         | 0.128*                   | 0.450*        | 0.442*     | 0.296*                      | 0.163*                               | 0.199*       | 0.018                     | 0.035                               | 0.513*                   | 0.254*|
| Expect Contents               | 0.007      | 0.021               | 0.011          | 0.010                    | 0.020         | 0.028      | 0.026                       | 0.020                               | 0.017       | 0.027                     | 0.017                               | 0.021                    | 0.019 |
| Approach of participation     | 0.184*     | 0.276*              | 0.197*         | 0.087                    | 0.476*        | 0.100*     | 0.200*                      | 0.107*                               | 0.141*       | 0.101*                    | 0.095                               | 0.404*                   | 0.202*|

* Correlation Coefficient Ratio: η² > 0.10
Participants’ Questionnaire Survey

Although participants’ questionnaire survey found that insight and purpose understanding of forests and forestry were not so high, “conservation activities” were the most “expected activities,” as indicated in “motivation for participation.” It is based on the recognition that forest volunteers local stakeholders accepting students in cooperation with the public and private officials of a relatively young generation. As shown in Table 8, as for the expectations to each university student, they want the students to understand the current situation of forestry and to engage in forestry.

DISCUSSION

Fig. 5 Pre/Ex post evaluation and growth rate.

Fig. 6 Graph of principal component loadings.

| Variable                  | Initiative | Ability to influence | Execution skill | Ability to detect issues | Planning skill | Creativity | Ability to deliver messages | Ability to listen closely and carefully | Flexibility | Ability to grasp situations | Ability to control stress | Ability to apply rules and regulations | Ability to group decisions | Ability to trust others | AVG |
|---------------------------|------------|----------------------|-----------------|--------------------------|----------------|------------|-----------------------------|----------------------------------------|-------------|---------------------------|-----------------------------|--------------------------------|---------------------------|-------------------------|-----|
| Pre-evaluation (X1)       | 1.05       | 0.50                 | 1.10            | 0.80                     | 0.80           | 0.50       | 0.85                        | 1.46                                   | 1.25         | 0.75                      | 1.25                        | 1.10                         | 0.95                     |            |     |
| Ex post evaluation (X2)   | 1.95       | 1.40                 | 1.65            | 1.60                     | 1.30           | 1.10       | 1.35                        | 2.16                                   | 1.80         | 1.50                      | 1.68                        | 1.60                         | 1.58                     |            |     |
| Growth Rate (%)           | 186%       | 280%                 | 141%            | 200%                     | 163%           | 220%       | 159%                        | 148%                                   | 144%        | 134%                      | 145%                        | 134%                         | 145%                     | 127%       |     |

Table 8 Expectations to each university student.
As was clarified in the questionnaire survey of this study, the purpose consciousness of the university students and motivation for participation were not necessarily related to forestry and forest. In addition, the major purpose of the universities that send out their students is for growth and learning of students, and the focus is placed on human resource development. Hasegawa (2016) is studying the number of participation days and the educational effect of group accommodation activities, and reports that it gives opportunities to think and behave actively, especially in lifestyle habits and group life, but this survey is based on primary school students and further examination is necessary for university students regarding the appropriate number of days and educational effects.

### Factor of Growth Rate of FCWS

From the averages of the correlation coefficients ($\eta^2 \leq 0.1$) of the 12 competencies, the attributes whose correlation was beneficial for “self-growth,” so recruitment from repeaters may have affected the recognition and understanding as it is symbolized by many respondents citing “recommendations from friends and seniors.” There are systems, like at Niimi College, where volunteer activities affect unit credits, and at Hiroshima University of Economics as part of extracurricular activities without credits for students. They serve as a big opportunity to connect students with volunteer activities, but many students also participate as repeaters even after they have acquired credits or completed the program. The long activity duration of 2 weeks is a considerable burden for students, a point where they might feel stressful, but the expectation to obtain more than such drawbacks is a big motivation for participation. Next, as symbolized by “participation and connection with local residents” about participation motivation, the deep involvement between local residents and students is driving the endogenous motivation of repeaters “to reunite again.” Aoyagi and Sato (2007) reports that participation objectives such as ‘easy to understand instructors’ and ‘meeting with people’ influence the degree of achievement about the satisfaction of forest volunteer activities, and in this volunteer activity, the expectation of “meeting with people” is similarly high.

As was clarified in the questionnaire survey of this study, the purpose consciousness of the university students and motivation for participation were not necessarily related to forestry and forest. In addition, the major purpose of the universities that send out their students is for growth and learning of students, and the focus is placed on human resource development. Hasegawa (2016) is studying the number of participation days and the educational effect of group accommodation activities, and reports that it gives opportunities to think and behave actively, especially in lifestyle habits and group life, but this survey is based on primary school students and further examination is necessary for university students regarding the appropriate number of days and educational effects.

### Table 8 What local people expect of university students

| Organization | Gender | Age | Answer |
|--------------|--------|-----|--------|
| NPO          | male   | 35  | Universities should increase opportunities to experience forestry for students so that they will see forestry as one of their job options. |
| City hall    | male   | 35  | To know mountains with artificial forests will die without human hands. |
| No answer    | male   | —   | Visit forests more often and learn through experiences working in the field of forestry. |
| Forestry worker | male  | 43  | Job ad for forest workers at university notice board. |
| Forestry worker | male  | 31  | Should communicate with others. |
|              | male   | 37  | Try to know about real forestry. Be more interested in forestry as they do not know the actual state. |
| City hall    | male   | 39  | To approach from various angles such as forest school for forests, woods, timbers forest volunteers, importance of Sotogama and its culture, characteristics of cypress and cedar, or use of broad leaf trees. |
| NPO          | male   | 39  | Know the importance of forestry and forests, and share their knowledge to as many people as possible. |
| City hall    | male   | 24  | Have knowledge about the current situation of Japanese forestry. Have their best experience in Niimi. |

### Table 7 Result of survey for local people

| Students Performance Satisfaction | Students Growth |
|---------------------------------|-----------------|
| Variable | n | Variable | n |
| Very satisfied | 3 | Very growth | 4 |
| Satisfied | 6 | Growth | 6 |
| Neither | 4 | Neither | 2 |
| Unsatisfied | 0 | A little | 0 |
| Very Unsatisfied | 0 | Not at all | 0 |
| No answer | 0 | No answer | 1 |
| Total | 13 | Total | 13 |

| Students Growing competency | n | % |
|-----------------------------|---|---|
| Initiative | 7 | 15% |
| Ability to influence | 5 | 11% |
| Execution skill | 4 | 9% |
| Ability to detect issues | 7 | 15% |
| Planning skill | 1 | 2% |
| Creativity | 3 | 6% |
| Ability to deliver messages | 3 | 6% |
| Ability to listen closely and carefully | 7 | 15% |
| Flexibility | 1 | 2% |
| Ability to grasp situations | 5 | 11% |
| Ability to apply rules and regulations | 1 | 2% |
| Ability to control stress | 3 | 6% |
| Total | 47 | 100% |

### Table 8 What local people expect of university students

| Organization | Gender | Age | Answer |
|--------------|--------|-----|--------|
| NPO          | male   | 35  | Universities should increase opportunities to experience forestry for students so that they will see forestry as one of their job options. |
| City hall    | male   | 35  | To know mountains with artificial forests will die without human hands. |
| No answer    | male   | —   | Visit forests more often and learn through experiences working in the field of forestry. |
| Forestry worker | male  | 43  | Job ad for forest workers at university notice board. |
| Forestry worker | male  | 31  | Should communicate with others. |
|              | male   | 37  | Try to know about real forestry. Be more interested in forestry as they do not know the actual state. |
| City hall    | male   | 39  | To approach from various angles such as forest school for forests, woods, timbers forest volunteers, importance of Sotogama and its culture, characteristics of cypress and cedar, or use of broad leaf trees. |
| NPO          | male   | 39  | Know the importance of forestry and forests, and share their knowledge to as many people as possible. |
| City hall    | male   | 24  | Have knowledge about the current situation of Japanese forestry. Have their best experience in Niimi. |
tion of other attributes is judged as appeared by experiential 
knowledge and grade, responsibility given, advance attitude 
and learning (Dewey, 1938). Matsukawa (2013) analyzed 
the questionnaire survey results of participants in forest vol-
unteers and non-participants, and suggests, as a means to 
increase the motivation for participation, it is needed to raise 
awareness and knowledge on environmental problems, and 
to remove social factors and environmental factors hindering 
participation. The difference appeared remarkably in the 
participation record, but it seems that if the new participants 
have detailed preliminary learning, it will also effectively act 
on the development of the capacity elements of the students. 
As shown in student attributes and motivation for participa-
tion, it is thought that the factor is interaction with students 
with diverse backgrounds.

Analysis of Growth Rate of Factors

“Ability to influence,” “creativity” and “ability to detect 
issues” are analyzed which show high growth rates. The 
human relationships among the members appear to have 
greatly influenced the training of “ability to influence.” In 
addition, there was an opportunity to talk about individual 
awareness and learning etc. through reflection in each daily 
meeting, which seems to have acted positively on “ability to 
influence,” but as Table 6 shows, it can be judged that the 
“objective comprehension degree,” most strongly correlated 
with “ability to influence,” had a great influence. Regarding 
“creativity,” “ability to detect issues” and “ability to grasp 
situations,” as this program is mainly managed by students, 
the participants had particularly strong consciousness on the 
management of day-to-day conservation activities and crisis 
management. The leader and deputy leader of this volunteer 
activity are selected from the repeaters, and there are vari-
ous kinds of awareness depending on the role. Therefore, the 
style of the student management is regarded as affecting the 
growth of the students, and thus this affected the correlation 
factor.

Principal Component Analysis of Growth Value

Regarding factors that lead to positive load values of the 
principal component 1 in forest volunteers, the review 
by self-evaluation was seemingly significantly affected. This 
result attributed to the fact that the sense of accomplishment 
that the experiences in extraordinary circumstances and the 
severe activities acted positively in a review of the partici-
pants. Yamato et al. (2013) reports that students’ sense of 
accomplishment and self-confidence were positive factors of 
self-evaluation, as the positive factor of the principal compo-
nent 1 loadings of the analysis of the various competencies 
aquired through experiential learning. Also, Nakayama and 
Matsumura (2018) reports similar results in the project 
activities of students with forest field, and this research also 
reveals the same trend as these results. Therefore, the factor 
name of the principal component 1 is judged as “accomplish-
ment factor by reflection”.

Next, regarding the principal component 2 loadings, 
since the five items out of the seven competency factors that 
showed a positive value were “ability to work in a team”, the 
characteristics of the program organized by students seems to 
be greatly affected. Especially in conservation activities, there 
are many opportunities to act on teams, by the crisis manage-
ment consciousness to grasp the situation constantly so as to 
ensure safety and to call for attention or appeal by voice. The 
preparation for thinning and removing the timber influences 
the profit of activities, and for this reason, cost-conscious 
planning is important for the activities. In fact, even though 
the activities are managed mainly by students, each team has 
an instructor, and the students receive severe feedback on 
behavior and method of work in daily activities. This works 
as a trigger for their own reflections and strongly increases 
their consciousness of problems. Therefore, the factor name 
of the principal component 2 was interpreted as “activity con-
tent factor.” Also, as shown by the variable plot (Fig. 7), the 
variables that affected the “activity content factor” that had 
almost no effect on “accomplishment factor by reflection” 
were “ability to apply rules and regulations,” “ability to influ-
ence,” and “creativity.” The thinning and maintenance work, 
as shown in Table 4, are particularly frequent in activities, 
and accompanied by danger. Therefore, work procedures, 
grasp of progress situation, work under severe circumstances, 
etc. have significantly affected their growth capacity.

Results of Questionnaire Survey for Local Stake Holders

The questionnaire survey for the local stakeholders 
(Table 8) received such comments as “I am glad to have 
hills in our local area cleaned up” and “I hope students can 
know more about our local area.” Through university 
students’ efforts, the locals have re-discovered the appeal of 
regional resources and the identity of the region. Such interac-
tions between the local stakeholders and university students 
showed “endogenous development” to activities to protect 
“regional resources (commons)” by Okuda and Inoue (2013). 
In Yamamoto (2000), the principal entities constituting 
forest volunteer activities are defined as administrative and local 
citizens, but forest volunteer activities in this study are a new 
type of forest volunteer activities that university students par-
ticipate in while playing a responsible role.

CONCLUSIONS

Also, in the survey of growth rate, the highest growth rate 
was 280% in “ability to influence,” followed by “creativity” 
220%, “ability to detect issues” 200%, and “ability to grasp 
situations” 200%. Although some abilities may influence 
the attribute, performing the principal component analysis 
to examine factors of their capacity growth, characteristics 
such as “accomplishment factor by reflection” and “activity 
contents factor” were clarified. In addition, from the variable 
plot of the principal component 1 and principal component 2,
“ability to influence,” “ability to apply rules and regulations,” and “creativity” are seen as features of the capacity growth attributable to “activity content factor” and these are defined as the effectiveness of forest education. Yamamoto (2014) discusses efforts to transform forest volunteer activities into “open commons” where diverse people participate in forest management. Hiyane (2009) points out that participation in forest planning has great significance as citizenship and introductory education to foster leadership, serving as human resource development strongly conscious of supporting the regional communities with knowledge about forest and rural villager’s activities.

In this study, there were similar results from the viewpoint of inducing the competency growth of university students and interests in the forest, forestry and inter-mountainous areas.

However, it will still be a problem to generalize a statement due to a comparatively smaller amount of acquired final data of participation. Moreover, in the method of self-evaluation, there is a problem in terms of objectivity, and to guarantee objectivity, it would be necessary to evaluate peers by diverse people (peer-evaluation) and the assigned instructor. In the future, further investigation and more data gathering are subjects and factors of competency growth from the viewpoints of participation motivation and hometown, experience value of subjects and comments are to be explored.

**LITERATURE CITED**

Aoyagi, K. and Saito, T. (2007) How to empower forest volunteers in order to have them participate in volunteer activities and cooperate with forest owners. Ringyo Keizai Kenkyu [J. For. Econ.] 53(1): 57–64 (in Japanese)

Aoyagi, K. and Saito, T. (2008) An attempt to evaluate leaders’ guiding abilities in forest volunteer activities: Questionnaire surveys for leaders in forest volunteer activities at a high school. Ringyo Keizai Kenkyu [J. For. Econ.] 54(3): 37–44 (in Japanese with English summary)

Dewey, J. (1938) Experience and Education. Trans: Ichimura, T. (2004) Keiken to Kyouiku. Kodansha, Tokyo, 176 pp

Hasegawa, Y. (2016) A study on the impact of the educational effect of the stay in group lodging activities. Bull. Natl. Inst. Youth Educ. 4: 71–80 (in Japanese)

Hamana, A. (2010) An international comparative research on outcome evaluation at undergraduate education and training generic skills. Report of the Grants-in-Aid for Scientific Research (B). https://kaken.nii.ac.jp/ja/file/KAKENHI-PROJECT-19330190/19330190selka.pdf. (accessed on Oct. 31, 2017) (in Japanese with English summary)

Hiyane, A. (2001) Philosophy of forest education and challenges of research. Shinrin Kagaku 31: 30–37 (in Japanese)

Hiyane, A. (2009) Forest environmental education and nature conservation education. Jpn. J. Environ. Education 19: 79–80 (in Japanese)
Ichihara, K., Toyokawa, T., Matsunaga, H. and Kayawake, H. (2008) The effect of forest works on volunteer’s mental state. J. Jpn. For. Soc. 90: 411–414 (in Japanese with English summary)

Matsukawa, T. (2013) Understanding volunteer participation and motivation in forestry. J. Human Environ. Stud. 11: 143–152 (in Japanese)

Ministry of Economy, Trade and Industry (METI) (2008) Shakaijinkisoryoku ikusei no tebiki [A guide to development of fundamental competencies for working persons] (in Japanese). Kawaiyuku, Nagoya, 558 pp

Nakayama, K. and Matsumura, N. (2018) Ability development measured by the fundamental competencies for working persons and effectiveness of forest environmental education: A Case study of the project based learning (PBL) at Hiroshima University of Economics. J. Jpn. For. Soc. 100: 20–25 (in Japanese with English summary)

Oishi, Y. and Inoue, M. (2014) Studies on forest education in Japan: Analysis focused on studies initiated in the 1980s and 1990s. J. Jpn. For. Soc. 96: 274–285 (in Japanese with English summary)

Oishi, Y. and Inoue, M. (2015) Forest education. Kaiseisha Press, Otsu, Shiga, 239 pp (in Japanese)

Okuda, H. and Inoue, M. (2013) Endogenous development” and “the commons” of a mountain village in Japan. Appl. For. Sci. 22(2): 1–11 (in Japanese with English summary)

Sekioka, H. (1998) Shinrin ringyo kyoiku ga mezasu mono [Aim for forest and forestry education*] (in Japanese). In: Zenrinkyou (ed) Shinrin ringyo kyoiku jissen gaido [Forest and forestry education practice guide*]. Zenrinkyou, Tokyo: 10–18

Yamamoto, S. (2000) The Present situation and the possibility of the forest volunteer: Focusing on the public sector building. Ringyo Keizai Kenkyu [J. For. Econ.] 46(2): 25–30 (in Japanese)

Yamamoto, S. (2007) Forest conservation and forest education based on public participation. Shinrin Kagaku 49: 15–18 (in Japanese)

Yamamoto, S. (2009) Forest environmental education in forest volunteer work. Abstr. 120th Annu. Meet. Jpn. For. Soc.: 389 (in Japanese)

Yamamoto, S. (2014) Forest volunteer activities as a social movement. J. Ohara Institute Soc. Res. 671–672: 3–16 (in Japanese)

Yamato, S., Kitagawa, H. and Tanaka, J. (2013) The activities and effectiveness of project based learning: For improving student’s practical skills. Proc. 23rd Natl. Conf. Soc. Proj. Manag. 2013: 211–216 (in Japanese with English summary)

* The English titles are tentative translations by the authors of this paper from original Japanese titles.

(Received 6 November 2017)

(Accepted 20 December 2017)