Profile of the ability of teachers in planning and carrying out 4C skills-oriented science teaching

I Setiawati1, Rusman1 and A Djohar1

1Study program of curriculum development, Graduate school of Universitas Pendidikan Indonesia, Jl. Dr.Setiabudhi No. 229, Bandung 40154, Indonesia

*Corresponding author’s email: intanasianto@gmail.com

Abstract. The aim of this research is to get the depiction of the ability of science teachers in planning and carrying out 4C (critical, creative, collaborative and communication) skills-oriented science teaching. The research method used is quantitative descriptive. The subjects of the research were 12 science teachers (7 female and 5 male) from several junior high schools in West Bandung district of West Java province. The instrument used for data collection is the teaching plan assessment rubric and the assessment rubric of real teaching that was adapted from the assessment rubric used for the performance test of the teacher profession program. Data analysis was carried out by reviewing; gender, teaching experience and teacher education background. The results showed that: 1) most of science teachers who were the subjects of the research had low ability to plan and implement of 4C skills-oriented science teaching, 2) there was no gender bias, no teaching experience bias and no teacher's educational background bias in the ability to planing and carrying out of 4C-oriented science teaching. The low ability of the science teachers indicates the need to increase teacher competency through relevant training programs.

1. Introduction

In order to survive and be able to compete in the 21st century, humans need to have and master various skills and knowledge needed in the 21st century. These skills include: (1) life and career skills, (2) learning and innovation skills, and (3) technology and media information skills. In addition, human resources need to master scientific literacy, which is the basis of the ownership of 21st century skills.

One of the 21st century skills areas that are a priority in the 2013 curriculum for students is learning and innovation skills which include: (a) critical thinking and problem solving, (b) communication and collaboration, (c) creativity and innovation, known as term 4C skills [1]. Critical thinking is thinking about problem solving and decision making [2], creativity is thinking out of the box [3], collaboration is related to working together to achieve common goals, and communication is related to how to best convey the ideas which they have to the community [4].

These 21st century skills can be provided in the context of formal and informal education. In formal education, 21st century skills can be built on students through face-to-face learning activities in the classroom and laboratory activities. In science learning, the existence of laboratory activities can be optimized for the role of training 21st century skills in students. To optimize the role of formal education in preparing human resources that can survive and be able to compete in the 21st century, the 2013 curriculum mandates 21st century skills training through learning activities using the scientific method.
In order for teachers to have the skills and readiness in planning and implementing science learning that is oriented towards 4C skills training, the government through the authorized institutions has held various teacher competency enhancement trainings in organizing 4C skills-oriented science learning. In addition, the government has also provided and supplemented various resource books as a guide for teachers in planning and implementing science learning oriented 4C skills training.

After a long period of dissemination and improvement of teacher competencies in the implementation of the 4C skills-oriented training in teaching, it is necessary to evaluate the results, in this case the ability of junior high school science teachers to organize 4C skill-oriented science teaching. This research was conducted to obtain an overview of the ability of junior high school science teachers to plan and implement 4C skills-oriented science learning for their students.

2. Methods

The method used in this study is quantitative descriptive. The subjects of the research were 12 science teachers (7 female and 5 male) from several junior high schools in West Bandung district of West Java province. The research subjects were selected purposively, because what we wanted to study in this research was the planning and implementation of 4C skills training oriented science teaching, so the chosen research subjects were teachers who had a 4C skills-oriented science teaching plan and were willing to implement it in science teaching in their class. The instrument used for data collection is the teaching plan assessment rubric and the assessment rubric of real teaching that was adapted from the assessment rubric used for the performance test of the teacher profession program. Data analysis was carried out by reviewing: gender, teaching experience and teacher education background of the teachers. Table 1 shows the scoring rubric for the 4C skill-oriented science learning plan.

| Nu | Elements of the teaching plan | Scoring component for each element of the teaching plan | Range of score |
|----|--------------------------------|--------------------------------------------------------|---------------|
| 1  | The teaching objectives       | a. Suitability of objectives with indicators of achievement of 4C skills competencies | 1 – 10         |
|    |                                | b. Verbs used in teaching objectives can be observed and measured | 1 – 10         |
|    |                                | c. Completeness of teaching objectives, including: attitudes, knowledge and 4C skills | 1 – 10         |
|    |                                | d. Complete formulation of teaching objectives, including: Audience, Behavior, Condition, Degree | 1 – 10         |
| 2  | Subject matter                | a. Suitability of subject matter with KD and 4C skill indicators to be achieved | 1 – 10         |
|    |                                | b. Systematic arrangement of subject matter | 1 – 10         |
|    |                                | c. Subject matter contains facts, concepts, principles or laws, procedures that are relevant and complete | 1 – 10         |
| 3  | Teaching strategy             | a. The models, approaches, methods and teaching strategies chosen are complete, according to basic competencies, in accordance with the character of the material, in accordance with the character of the students and can train 4C skills | 1 – 10         |
|    |                                | b. The steps or syntax of teaching in accordance with the teaching model used | 1 – 10         |
|    |                                | c. The stages of teaching activities include introduction, core activities and closing equipped with time allocation for each activity | 1 – 10         |
d. Demonstrate the application of active learning / scientific learning and 4C skills training oriented teaching

| 4 Teaching tools and media | a. Suitability of the selection of teaching media with teaching objectives, subject matter, class conditions, and work safety and tools | 1 – 10 |
| b. The suitability of both printed and electronic learning resources chosen with 4C skill competencies | 1 – 10 |
| c. Complete plan for the use of teaching materials and tools (worksheets, job sheets, materials and practicum tools) | 1 – 10 |

| 5 Evaluation | a. Complete coverage of 4C skills assessment aspects | 1 – 10 |
| b. Appropriate evaluation with teaching objective and 4C skills indicators | 1 – 10 |
| c. The completeness of the assessment component includes the question grid, item questions, key answers, attitude instruments, skill instruments and scoring rubrics | 1 – 10 |

Table 2 shows the rubric for scoring the implementation of 4C skills training oriented science teaching.

**Table 2. Rubrics for scoring implementation of 4C skills training oriented science teaching**

| Nu  | Elements of real teaching | Components of the elements of learning implementation | Range of score |
|-----|---------------------------|----------------------------------------------------|----------------|
| 1   | Opening teaching activities |                                                     |                |
|     | a. Preparing students physically and mentally (greeting, praying, asking about the condition of students, and checking student attendance) |                                                     | 1 – 10         |
|     | b. Motivate students by presenting phenomenology or problems related to 4C skills |                                                     | 1 – 10         |
|     | c. Deliver apperception |                                                     |                |
|     | d. Delivering learning objectives includes 4C skills |                                                     | 1 – 10         |
|     | e. Deliver the scope of the subject matter |                                                     | 1 – 10         |
| 2   | The main activities of teaching |                                                     |                |
| - Mastery of subject matter | a. Presenting subject matter in accordance with the objectives, containing the truth of the concept and linking it with other relevant knowledge |                                                     | 1 – 10         |
|     | b. Delivering subject matter systematically and sequentially |                                                     | 1 – 10         |
|     | c. Use the right lab tool, explain the job sheet and worksheet for practical activities that provide 4C skills |                                                     | 1 – 10         |
|     | d. Implement concepts / subject matter in daily life that are relevant to 4C skills |                                                     | 1 – 10         |
| - Model/approach/strategy | a. Reflecting active and scientific teaching that encourages students to carry out activities that provide direct experience such as: observing / |

Table 2 shows the rubric for scoring the implementation of 4C skills training oriented science teaching.
experimenting, interacting and collaborating, stimulating high-level thinking (critical / creative) and fostering joy.

b. Grow positive habits, such as getting students to discipline, cooperation, daring to ask questions and opinions, communicating and giving appreciation

c. Using tools / materials and teaching media that foster active participation of students, strengthen understanding and skills 4C

d. Assess the learning process to monitor student learning progress for example by holding a short quiz

e. Assess learning outcomes to conduct assessments according to the competencies to be achieved, both attitudes, knowledge and skills 4C

f. Conduct classroom management that can create an academic atmosphere that supports productive learning activities related to 4C skills

g. Using communicative language, polite, according to the development of students, not SARA, bullying with intonation and appropriate tone, clearly heard

h. Having social sensitivity that is shown by a sense of empathy and care for the needs of students and the learning environment, is open to differences in student conditions)

i. Having a good personality that is indicated by having an open attitude, friendly gestures, acknowledging mistakes with grace, accepting criticism, being polite, clean and showing enthusiasm

3 Closing teaching activities

a. Summarizes the subject matter by involving students

b. Reflect and follow up through evaluation activities, feedback and further study plans

c. Plan remedial teaching and enrichment activities

To determine the category of science teacher's ability to plan and implement science teaching oriented 4C skills training used guidelines as shown in Table 3.

**Table 3. Guidelines for determining the category of science teacher abilities in planning and implementing 4C skills training oriented science teaching**

| Range of score (S) | Category of ability |
|-------------------|---------------------|
| 7.5 ≤ S ≤ 10      | High                |
| 6.0 ≤ S ≤ 7.5     | Moderate            |
| S ≤ 6.0           | Low                 |
3. Results and Discussion

Table 4 shows the average score of planning for 4C skills-oriented science teaching. In Table 4, it appears that the average ability of science teachers to plan 4C skills training oriented science teaching is still low. In the table it also appears that there is no gender bias, no teaching experience bias and no background of teacher educational bias in the ability to plan 4C skills-oriented science teaching.

**Table 4. Average score of the 4C skills-oriented science teaching plan achieved by each teacher**

| Teacher | Gender | Teaching experience (year) | Background of teacher educ. | Average score of teaching plan | Category of ability |
|---------|--------|-----------------------------|------------------------------|-------------------------------|---------------------|
| T1      | Female | 5 – 10                       | Bachelor of Physics Educ.    | 5.1                           | Low                 |
| T2      | Male   | 5 – 10                       | Bachelor of Biology Educ.    | 4.7                           | Low                 |
| T3      | Male   | 0 – 5                        | Bachelor of Physics Educ.    | 4.8                           | Low                 |
| T4      | Female | > 20                         | Bachelor of Physics Educ.    | 4.8                           | Low                 |
| T5      | Female | 10 – 15                      | Bachelor of Biology Educ.    | 4.6                           | Low                 |
| T6      | Female | 10 – 15                      | Bachelor of Science Educ.    | 4.9                           | Low                 |
| T7      | Male   | 0 – 5                        | Bachelor of Physics Educ.    | 5.3                           | Low                 |
| T8      | Female | 0 – 5                        | Bachelor of Biology Educ.    | 4.7                           | Low                 |
| T9      | Male   | > 20                         | Bachelor of Biology Educ.    | 4.5                           | Low                 |
| T10     | Female | 10 – 15                      | Bachelor of Physics Educ.    | 5.2                           | Low                 |
| T11     | Female | 10 – 15                      | Bachelor of Biology Educ.    | 4.6                           | Low                 |
| T12     | Male   | 5 – 10                        | Bachelor of Physics Educ.    | 5.1                           | Low                 |

Table 5 shows the average score of the implementation of 4C skills training oriented science teaching. In Table 5, it appears that the average ability of science teachers to carry out 4C skills training oriented science teaching is still low too. In the table it also appears that there is no gender bias, no teaching experience bias and no teacher education background bias in the ability to implement 4C skills-oriented science teaching. This result in line with previous research that also found that integrating of 4C skills in the learning process will improve students’ 4C skill [5].

**Table 5. Average score of the 4C skills-oriented science teaching implementation achieved by each teacher**

| Teacher | Gender | Teaching experience (year) | Background of teacher educ. | Average score of real teaching | Category of ability |
|---------|--------|-----------------------------|------------------------------|-------------------------------|---------------------|
| T1      | Female | 5 – 10                       | Bachelor of Physics Educ.    | 6.0                           | Moderate            |
|   | Gender | Age Range | Education Level | Ability Level |
|---|--------|-----------|-----------------|--------------|
| T2 | Male   | 5 – 10    | Bachelor of Biology Educ | 5.4 | Low |
| T3 | Male   | 0 – 5     | Bachelor of Physics Educ. | 5.5 | Low |
| T4 | Female | > 20      | Bachelor of Physics Educ. | 5.2 | Low |
| T5 | Female | 10 – 15   | Bachelor of Biology Educ. | 5.2 | Low |
| T6 | Female | 10 – 15   | Bachelor of Science Educ. | 5.7 | Low |
| T7 | Male   | 0 – 5     | Bachelor of Physics Educ. | 6.2 | Moderate |
| T8 | Female | 0 – 5     | Bachelor of Biology Educ | 5.4 | Low |
| T9 | Male   | > 20      | Bachelor of Biology Educ. | 4.9 | Low |
| T10| Female | 10 – 15   | Bachelor of Physics Educ. | 5.9 | Low |
| T11| Female | 10 – 15   | Bachelor of Biology Educ | 5.2 | Low |
| T12| Male   | 5 – 10    | Bachelor of Physics Educ. | 5.8 | Low |

The results of the research indicate that professional development activities through the implementation of training have not produced the results as expected. Based on the results of interviews with several science teachers who have participated in various training activities organized by authorized institutions about 4C skills and organizing science teaching of 4C skills oriented shows that the main causes of their ability are still low after participating in training activities because the training content and activities are still general at the policy level and theoretical which tends to provide knowledge only, has not swooped at the operational level and is practically oriented to train skills in making plans for science teaching oriented 4C skills and its implementation via workshop.

4. Conclusion
The conclusion that can be drawn from the results of this study is that most of science teachers have a low ability to plan and implement 4C skills-oriented science teaching. There is no gender bias, no teaching experience bias and no teacher's educational background bias in the ability to plan and implement 4C skill-oriented science teaching. The implication of the results of this research is that there needs to be a change in the training program for increasing the ability of natural science teachers to plan and implement science learning oriented to 4C skills training, from what used to be traditional training models that tend to be theoretical with new training models that prioritize modeling and workshops.

5. References
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