Comparative study of laboratory management capability among physics students at UIN Sunan Gunung Djati and UIN Sunan Kalijaga

M M Chusni¹², A Hasanah³, A M Ghazali⁴, R Zakwandi², R F R Nurzaman², M F Nurfauzan², Y Dirgantara², R D Agustina², A Malik² and A Samsudin⁵

¹Post Graduate School of Natural Science, Universitas Sebelas Maret Surakarta, Solo, Indonesia
²Physics Education Department, Universitas Islam Negeri Sunan Gunung Djati, Bandung, Indonesia
³Islamic Education Department, Universitas Islam Negeri Sunan Gunung Djati, Bandung, Indonesia
⁴Faculty of Usuluddin and islamic study, Universitas Islam Negeri Sunan Gunung Djati, Bandung, Indonesia
⁵Physics Education Department, Universitas Pendidikan Indonesia, Bandung, Indonesia

*Corresponding author’s email address: minan.chusni@uinsgd.ac.id

Abstract. The aim of this research is to compare the laboratory management capability of the students in the physics education department at UIN Sunan Gunung Djati Bandung and UIN Sunan Kalijaga Yogyakarta. The research method is used comparison method between two groups subject. The comparison is doing to describe the readiness of physics education department to prepare their students become a professional pre-service physics teacher. Subjects in the research are students of physics education department at UIN Sunan Gunung Djati and UIN Sunan Kalijaga that choice used purposive sampling method. The data of management laboratory capability were collected by spreading the instruments in the form of a multiple choice test and analyze used t-test method. Result of the study show that sig 0,488 > 0,05 that indicated the subjects have not differences. The analyze of the levels of difficulty is show that each of the subjects group does not have a significant difference in value. Generally, the researchers conclude that not have significant differences among the student capability. Other than, this study also indicates that the lecture of management laboratory must be improved to increase the levels of graduation capabilities.

1. Introduction

The learning process is affected by some factors that coming from the internal subject (the student) or the teacher as the learning facilitator [1,2]. The teacher factors are important that affects to learning process. This reason is caused by the role of the teacher from the planning, doing, and evaluating of learning process. The expectation is the student having the motivation to more exploring the learning matter and have them in a lovely way to the science [3–5]. The teacher ability to do the learning process is not separate by the readiness of the pre-service teacher to become a professional teacher. The readiness includes the physical and psychological aspect of the pre-service teacher to apply the pedagogical
knowledge at the real schools [6]. It is mean after the student follows the education program at the university. The readiness is also to define as emotional maturity and adult to implementation the knowledge in a real context [7]. Therefore, the aspects of readiness of pre-service physics teacher are emotional maturation, capability, attitude and interaction that including as four basics competence that pedagogic, professional, social and personality [8,9]. For the science learning process, the additional competencies that must be having by the science teacher are the knowledge of the laboratory. This is to support the learning process with the use of the laboratory as the science education facility at the school [10,11]. Teacher ability of management laboratory includes conceptual knowledge such as definition, how to describe the purpose of laboratory activity, describing the function of school laboratory, how to classify the laboratory, knowledge of laboratory organization and how to solve the limitation of laboratory access or property [12–14]. The procedural ability including planning, of the laboratory building, planning of laboratory activity, supplying, repairing, first aid, up to how to manage the laboratory waste by experiment activity [1,15,16].

The study aims to analyses management laboratory capability of higher education institution that is UIN Sunan Gunung Djati Bandung and UIN Sunan Kalijaga Yogyakarta. The analyse is doing by review the correlation between management laboratory capability and the readiness become a professional physics teacher. the teacher with professional competence is expected to increase the learning quality at the school in elementary or high school (Junior and Senior). The last part of this research is to compare the capability of both group subjects. This is to describe the capability of pre-service physics teacher and delineation of effectivity by department program to smooth the physics teachers. As the output of this research is may use as references of the police department of each physics department to increase or improve the learning quality.

2. Methods
This research is used the comparative descriptive method of two independent sample (group subject). The subjects in this study are physics students at UIN Sunan Gunung Djati and UIN Sunan Kalijaga that choose by purposive sampling method. The subjects are the students who have to get advance physics schools laboratory in their department. The subject in the first group (UIN Sunan Gunung Djati) is 43 respondents and in the second group (UIN Sunan Kalijaga) is 45 respondents. The data is collected with separating instruments test with the multiple-choice question that representatives of every aspect of management laboratory. Every aspect in this study consists of three question with levels C2-C6 in Bloom's taxonomy. The data is processed with the independent sample t-test that refers to the data is normal and homogeny [17]. The aspect that focused on this study is knowledge domain only, so in the next research, we can focus on another aspect such as psychomotor and affective aspect. The knowledge domain includes the definition, kind of laboratory, school laboratory, design laboratory, layout, installation (water, electric, gas and wasted), laboratory organizer, administration, rules and guide, safety, first aid, procurement, care and repairmen of tools, knowledge of wasted, and sewage treatment.

3. Result and Discussion
The result of management laboratory capability of both group subjects is shown in table 1.

| No. | Group subjects          | df | Sig   | Interpretation |
|-----|-------------------------|----|-------|----------------|
| 1   | UIN Sunan Gunung Djati  | 30 | 0.065 | Normal         |
| 2   | UIN Sunan Kalijaga      | 30 | 0.058 | Normal         |

Based on the data in table 1 indicate the data is normal with significance in each group subject is lower than 0.05 [18]. The data has been the test of homogeneity and indicate the data is homogeny (see table 2) with significances 0.234 that higher than 0.05 [19].
Table 2. The result of t-test

| Levene's Test for Equality of Variances | t-test for Equality of Means |
|----------------------------------------|-----------------------------|
| F                                      | Sig. | t    | Df | Sig. (2-tailed) | Std. Error Difference |
| Equal variances assumed                 | 0.234 | 0.630 | 0.697 | 68 | 0.488 | 2.42903 |

Based on the number of the significance of t-test (see Table 2) that 0.488 that higher than 0.05 so the result of this research indicates that no significant difference among the student management laboratory capability [19].

The management laboratory capability aspect of each group is shown in Table 3.

Table 3. The result of student capability

| Management laboratory aspect              | Group subject 1 | Group subject 2 |
|------------------------------------------|-----------------|-----------------|
| Definition of laboratory                 | 42.71           | 54.07           |
| Kind of laboratory                       | 15.63           | 25.56           |
| School laboratory                        | 78.13           | 64.44           |
| Design laboratory                        | 93.75           | 77.78           |
| Layout of laboratory                     | 3.13            | 6.67            |
| Installation                             | 30.21           | 31.11           |
| Laboratory organizer                    | 71.88           | 71.11           |
| Administration in laboratory             | 57.03           | 53.89           |
| Rules and guided                         | 6.25            | 17.78           |
| Safety                                   | 56.25           | 52.22           |
| First aid                                | 68.75           | 57.78           |
| Procurement                              | 9.38            | 11.11           |
| Care and repairmen of tools              | 18.75           | 26.27           |
| Knowledge of wasted                      | 71.88           | 22.22           |
| Sewage treatment                         | 48.44           | 47.78           |

Table 3 shown the different subject capability. Based on the data, the difference of student capability is not too significant. The first group has the average capability 44.81 and second group is 41.32. But, if we see the distribution of each aspect, all student is less known in aspect layout laboratory with the number of 4.9 only. This result indicates that most student is cannot place the facilities in the laboratory. The other aspect that less is procurement, rules, and guide, and kind of laboratory. Their aspect is depending on the student experience in the laboratory. Especially on their interesting to the laboratory. Based on table 3, we can see the other information that the student has good knowledge about school laboratory with the number 71.29 and design of laboratory with the number 85.77. It indicates that the student is quite ready if placed as the physics teacher at the junior or senior high school.
Figure 1. The values of UIN Sunan Gunung Djati group subject in each level.

Figure 2. The values of UIN Sunan Kalijaga subject in each level.

Figure 1 and figure 2 shown that the distribution of the student's answer. Based on the figure, we get the information that in an easy type of question (the level C1 and C2 by Bloom's taxonomy) the student in each group subject has the right answer. In the percentage point of view, the group subject in UIN Sunan Gunung Djati is higher than group subject in UIN Sunan Kalijaga. The number is 67% for the student at UIN Sunan Gunung Djati and 62% in UIN Sunan Kalijaga. Generally, the data is shown that the student's capability is low because the percentage in the normal distribution the student must get 70% subject to have the right answer [20].

Next is the question in middle levels difficulty (C3-C4) with the subject who has the right answer decrease in each group subject. The group subject of UIN Sunan Gunung Djati get the 54% right answers and the group subject of UIN Sunan Kalijaga get 54% right answers with the average is 50%. It is normal in the figure of normality in middle levels difficulty [20].

The data analyses of answer distribution in high-level difficulty are shown the same percentage of each group subject. Average of right answer is 33.5% that higher than the normal percentage with number 3.5% with the normal distribution is 30% subject get the wrong answer in low level of difficulty question, 40% get the right answer for the middle level of difficulty of question, and 30% of subjects get the right answer for the high levels of difficulty question.
Figure 3. Mapping of management laboratory capability reviewed by type of knowledge

Based on the Figure 3 the student ability to answer the question of procedural knowledgeability is lower than conceptual knowledge about the laboratory activity. Specifically, the right answer to the procedural question is 8 of 20 for the group subject in UIN Sunan Gunung Djati and 5 of 20 for the group subject in UIN Sunan Kalijaga. This result is the difference between the conceptual question that most subjects of the groups have the right answers. For the real population, this result will be affected by the laboratory activity. This has happened because the laboratory activity is more need for procedural knowledge and procedural capability in the learning [21].

4. Conclusion
The student capability of management laboratory is affected by readiness to become a professional pre-service physics teacher. Based on the result of this study the student capabilities of management laboratory do not have signification differences and still low in each group subjects. Generally, the lecture programed of management laboratory must be improved to increase the levels of capabilities by the students.

5. References
[1] Akhtar S, Irshadullah H M, Inamullah H M and Tariq M 2017 Teaching of Physics with Physics Suite on the Achievement of Secondary Students Dialogue (Pakistan) 12 (2)
[2] Ruzek E A, Hafen C A, Allen J P, Gregory A, Mikami A Y and Pianta R C 2016 How teacher emotional support motivates students: The mediating roles of perceived peer relatedness, autonomy support, and competence Learn. Instr. 42 95–103
[3] Kember D 2016 Motivating Students through Teaching and Learning Understanding the Nature of Motivation and Motivating Students through Teaching and Learning in Higher Education, (Singapore: Springer Singapore) 79–97
[4] Copriady J 2015 Self-motivation as a Mediator for Teachers’ Readiness in Applying ICT in Teaching and Learning Procedia - Soc. Behav. Sci. 176 699–708
[5] Torrente J et al 2014 Development of Game-Like Simulations for Procedural Knowledge in Healthcare Education IEEE Trans. Learn. Technol. 7 1, 69–82
[6] Corlu M S, Capraro R M, and Çorlu M A 2015 Investigating the Mental Readiness of Pre-Service Teachers for Integrated Teaching 7 117–28
[7] Lavery S D and Coffey A 2016 ResearchOnline @ ND Service-learning: promoting the development of the graduate professional standards in pre-service secondary teachers
[8] Wanless S B and Dmitrovich C E 2015 Readiness to Implement School-Based Social-Emotional Learning Interventions: Using Research on Factors Related to Implementation to Maximize Quality Prev. Sci 16. 8 1037–1043
[9] Ibrahim A, Aulls M W and Shore B M 2017 Teachers' Roles, Students' Personalities, Inquiry Learning Outcomes, and Practices of Science and Engineering: The Development and Validation of the McGill Attainment Value for Inquiry Engagement Survey in STEM Disciplines Int. J. Sci. Math. Educ. 15 7 1195–1215

[10] Caleo I S, Tan Y S M and Cho Y H 2018 Does Teaching Experience Matter? The Beliefs and Practices of Beginning and Experienced Physics Teachers Res. Sci. Educ. 48 1 117–149

[11] Hofstein A 2017 The Role of Laboratory in Science Teaching and Learning Science Education 357–368.

[12] Alghamdi A, Tamimi O, Balgaith M, Bannan A, and Ayoub K 2014 Cardiac catheterization laboratory, organization, and metrics Eur. Hear. J. Suppl. 16 B75–B75

[13] Dey P 2018 Quality Control and Laboratory Organization Basic and Advanced Laboratory Techniques in Histopathology and Cytology 263–269

[14] Cohen J E 1981 Publication rate as a function of laboratory size in three biomedical research institutions Scientometrics 3 6 467–487

[15] Malik A et al. 2018 Using hot lab to increase pre-service physics teacher’s critical thinking skills related to the topic of RLC circuit J. Phys. Conf. Ser. 1013 1 012023

[16] Setiawan A, Malik A, Suhandi A, and Permanasari A 2018 Effect of Higher Order Thinking Laboratory on the Improvement of Critical and Creative Thinking Skills IOP Conf. Ser. Mater. Sci. Eng. 306 1 012008

[17] Malik A, Setiwana A, Suhandi A, and Permanasari A 2017 Learning Experience on Transformer Using HOT Lab for Pre-service Physics Teacher’s J. Phys. Conf. Ser. 895 1 012140

[18] Chusni M M 2016 Studi Komparatif Pendekatan Verifikasi dan Pendekatan Inkuiri Terbimbing Terhadap Kognitif Siswa SMP pada Materi Pesawat Sederhana EduFisika 1 2 01–08

[19] Levin J R 2015 Single-Case Research Design and Analysis: Comments and Concerns Routledge.

[20] D’Agostino R B 2017 Tests for the Normal Distribution Routledge

[21] Nieves J and Haller S 2014 Building dynamic capabilities through knowledge resources Tour. Manag., 40 224–232

Acknowledgments
The researches thanks to LP2M UIN Sunan Gunung Djati on donation to this research in BOPTN DIPA 2018. The researcher is also thanks to the physics education department at UIN Sunan Gunung Djati Bandung and UIN Sunan Kalijaga Yogyakarta as the location of this research is doing.