

# Improving Understanding of Application of ISO/IEC 17025 with the Role-Playing and Simulation Methods in Laboratory Management

Tri Esti Purbaningtrias<sup>a,\*</sup>, Thorikul Huda<sup>a</sup>

<sup>a</sup>Diploma of Analytical Chemistry, Islamic University of Indonesia

\*Corresponding author: tri.esti.p@uii.ac.id

**ABSTRACT:** The application of role-playing learning with self-assessment had been done in the course of Laboratory Management. The application of role-playing learning with self-assessment has been done in the course of Laboratory Management. The learning of role-playing used the module scenario that has been developed based on the general requirements for the competence of testing laboratory and calibration laboratory as stipulated in SNI ISO / IEC 17025. The development of role-playing learning was done through three materials, the making of quality documents, internal audit, and management review, in which each student material will perform the role and proven by video. Self-assessment was based on the competency unit in SKKNI Field of Laboratory Testing Services MSL91600A Develop and maintain laboratory documents, MSL933002A Contribute to the achievement of quality objectives, MSL934002A Implement quality system and continuous improvement process, MSL936001A Maintain quality system and continuous improvement process in work environment, and MSL936002A Carry out internal audits of the quality system. The application of role-playing with self-assessment could give an influence to the improvement of student competency achievement in the competency unit. In class A, student's score of student's previous competency points 39.35% rose to 67.75% and class B rose from 46.51% to 68.95%. The application of role-playing in Laboratory Management could improve the learning outcomes, there is an increase in the number of students who get the value of A that is 13.04% rose to 27.42% while the number of students who got  $\leq$  C decreased 7.22% i.e. from 21.74% to 14.52%. In addition, the application of role-playing method could improve the teaching performance of lecturer by students that is 3.43.

**Keywords:** quality document, internal audit, management review, role-playing, self-assessment, ISO / IEC 17025

## INTRODUCTION

Since experiencing curriculum changes in 2014 has implemented several courses also have been one of them at the Laboratory Management course. This is done in an effort to improve the excellence of Chemical Analysis Department in preparing young professionals who understand the ISO/IEC 17025 laboratory quality management system. This is done Chemical Analysis Department in facing the ASEAN Community challenge which will start on December 31, 2015. World free market demanded technical information of traded products. Test data from the laboratory that cannot be justified scientifically and the law will become one of the technical obstacles. Laboratory organizations need to be systematically and transparently directed and controlled in order to succeed. Success can be achieved through the implementation and maintenance of a quality management system designed to constantly improve the effectiveness and efficiency of its performance while considering the needs of all interested parties. Therefore, laboratories that wish to be recognized internationally must obtain accreditation that is formal recognition given by accreditation body to the competence of an institution or organization in doing certain conformity assessment activity based on the internationally agreed standard.

All laboratories wishing to gain international accreditation recognition shall comply with the requirements or clauses contained in ISO/IEC 17025. One of the clauses contained in ISO/IEC 17025 is the determination of management requirements [1]. Chemical Analysis Department has a learning outcome that includes three parameters, which have the ability in the field of work, the scope of work based on knowledge mastered and managerial skills are presented in Table 1. The predicted learning achievement also needs to be proved by the evidence that can be used for states that graduates have competence in accordance with standards through the process of competency certification.

The course of Laboratory Management is the course that must be taken by students in semester 4. The purpose of the Laboratory Management course in Chemical Analysis Department, Faculty of Mathematic and Natural Science, Islamic University of Indonesia is to provide an understanding of laboratory management including standards related to laboratories, technicians or analysts, waste management laboratory. By following the laboratory management course, students can understand about the standard in chemical laboratory management, laboratory organization, laboratory design, material supply, equipment, instrumentation. It is also related to the activities in laboratory chemistry concerning safety and security in the laboratory, material safety and data sheet (MSDS), quality system in chemical laboratory related to ISO 17025. With the comprehensive understanding of ISO 17025 graduated from Chemical Analysis Department UII can manage the laboratory well and able to guarantee the quality of test or calibration results in the laboratory.

The subjects of Laboratory Management are conducted to support the competence in developing and maintaining laboratory documents, implementing internal audit system, carrying out interpersonal communication and preparing laboratory documentation, in accordance with competency standards in SKKNI and SKN-KA. Thus this course is an inseparable element in order to realize the vision and mission of Chemical Analysis Department to give birth to young professionals who are competent in the field of chemical analysts that bring grace to the universe.

**TABLE 1.** Learning Outcome Chemical Analysis Department

<b>Parameter</b>	<b>Description of Learning Achievement</b>	
Ability in the field of Work	K1	Being able to choose and carry out chemical testing in accordance with the characteristics of the matrix based on standard test method or standard is not good in Bahasa Indonesia and English
	K2	Able to operate and perform calibration of chemical testing instruments in accordance with established procedures
	K3	Able to perform validation and/or verification of testing and calibration methods
	K4	Able to process data test results and inform in the form of written or oral reports
Scope of work based on knowledge mastered	P1	Mastering the concept of chemistry, in general, to be applied in chemical testing according to established procedures so that it can be used on the job field
	P2	Mastering about functions, how to operate and how to maintain and maintain chemical testing instruments
Managerial Capabilities	M1	Able to be responsible for the results of chemical testing conducted independently and/or group by prioritizing aspects of occupational safety and security in the laboratory and able to take the right decision on the results of chemical testing.
	M2	Able to manage test results in the laboratory for authentication, originality and repetition studies
	M3	Able to develop and maintain cooperation with colleagues or outsiders

The learning activity of Laboratory Management in the previous two years is based on cooperative learning which is a teaching and learning strategy that emphasizes attitude or behavior together in working or assisting among others in a regular structure of cooperation in the group, consisting of two or more people. In completing the task of the group, each student group member must work together and help each other to understand the subject matter. Students will also follow the field study method by visiting in laboratories (industry, hospitals, government agencies) and case management system studies in several laboratories so as to compare laboratory designs and design laboratory management systems. Based on this method, at the beginning of the lecture that is at the meeting before mid-term examination, students experience saturation in following the lectures in the class that is only monotonous in the activity of information transfer from the lecturer to the students through the presentation media. This method makes the students do not get a clear picture of the material presented. New students will understand the laboratory management after visiting laboratory visits in real laboratories. The visit can directly see the implementation of laboratory management theories in the classroom in the world of work so that students can better understand and understand the meaning of management systems in the laboratory. Therefore, in this teaching grant proposed role-playing and simulation learning methods. The role-playing method is widely developed on social learning to gain experience of learning through characterization followed by learning reflection. Reflection on learning is useful for providing feedback from each learning experience

that has been followed. Playing a role can train a person to animate the characters played so that the values implied in the learning materials can be perceived by the learners.

This method of study combines theory and practice at a time. Students are not only given theories about Documents Level I to IV, internal audit, and management review but also play a role and simulation in the making of the document, the implementation of internal audit and management review. Thus it is expected that students can understand the material from the beginning so as to improve managerial skills as well as course scores. Learning by this method in the classroom course will be more fun so as to reduce student saturation.

The application of this method has also been supported by Chemical Analysis Department by forming a new laboratory that is ISO 17025 Simulation Laboratory. It is expected that with this laboratory, students can simulate laboratory management system based on ISO 17025. In addition, on Thursday 30 July 2015, Diploma of Analytical Chemistry has organized the Best Practice Workshop of ISO 17025 which is attended by all lecturers, as well as laboratory staff and administrative staff of Chemical Analysis Department to prepare competent resources in laboratory management system

Based on the above description, it can be formulated two problems as follows:

1. Does the application of role-playing and simulation give influence to the achievement of student's competence in Laboratory Management?
2. Will the application of role-playing and simulation in Laboratory Management improve the learning outcomes?

## LITERATURE REVIEW

### Role-Playing and Simulation

The simulation teaching method is divided into 3 groups as presented below:

1. Sociodrama: a kind of social drama is used to inculcate the ability to analyze a particular social situation,
2. Psychodrama: almost similar to sociodrama. The difference lies in the suppressor. Sociodrama emphasizes social issues, while psychodrama emphasizes its psychological influence
3. Role Playing: role-playing or role play aims to describe a past event.

Role Playing method is a way of mastery of learning materials through the development of imagination and appreciation of students. The development of the imagination and appreciation of the students by playing it as a living figure or inanimate object. This game is generally done more than one person. It depends on what is played. Role Playing method is one of the teaching and learning processes that belong to the simulation method. Simulation is a general term relating to constructing and operating a model that replicates the behavior processes. Hamalik argues that the simulation method is a way of teaching by doing the behavior process artificially [2]. According to Mulyatiningsih, role-playing or role-playing method is done by directing learners to imitate the activity outside or dramatize the situation, ideas, special characters [3]. The use of role-playing method can train trained learners' ability (including intelligence) on learning materials, train concentration in role-playing and fantasy (improvisation power) and increase interest in learning [4]. According to Roestiyah, role-playing can be used to dramatize social problems, though some research indicates that this method can be used for learning related to science issues [5].

Role-playing can be used for all types of ages. In addition, this role play method also has advantages in its use such as [6]:

1. Students train themselves to understand and remember the contents of the material to be played. As a player must understand, appreciate the overall story content, especially for the material that must be played. Thus, students' memory should be sharp and long-lasting.
2. Students will practice taking the initiative and creative. During the role play, the players are required to express their opinions according to the time available.
3. Talent available to students can be nurtured so that it is possible to appear or grow the seeds of drama art from school.
4. Cooperation between players can be grown and built with the best.
5. Students have a habit of accepting and sharing responsibilities with each other.
6. The spoken language of the student can be nurtured into a better language in order to be easily understood by others.
7. Can impress strongly and durable in student's memory.
8. It is interesting for students, allowing the class to be dynamic and full of enthusiasm

9. Awaken the passion and spirit of optimism in students and foster a sense of togetherness and solidarity social high
10. Able to appreciate events that take place easily, and can pick wisdom grains contained in it with the appreciation of students themselves
11. It is possible to improve the professional ability of the students and to cultivate/open opportunities for employment.

The development of role-playing by using games in chemistry learning becomes a good method according to the assessment of media experts, material experts, educators and learners [7]. Therefore, the learning that will be done in the course of Laboratory Management is by making a student role as a chemical analyst who will perform management system in laboratory testing. This play role will be an illustration when students work well in testing laboratories.

The learning steps that will be used are as follows:

1. Lecturer explains the learning objectives and competencies to be achieved
2. The lecturer gives scenarios in the lecture module to be studied
3. Lecturers divide learners into groups to play the role of teams that will conduct laboratory management systems in the field
4. The student group presented the results of its role in conducting laboratory management system in the field
5. Other groups are tasked with observing and evaluating the roles of each student
6. Students reflect the activities together with self-assessment.

## RESEARCH METHODS

The design of activities in the course of Laboratory Management includes:

1. Repair Course Outline, Lecture Course Unit (SAP), and Lecture Module  
Course outline and SAP are arranged according to the stage of role-playing and simulation. During the implementation of the lecture, students are given material that contains learning scenarios including making Document Level I-IV, internal audit and management review. Document preparation guidelines, internal audit, and management review refer to ISO / IEC 17025 [8]. The implementation of the ISO / IEC 17025 quality management system will be applied in the role of the students in making the I-IV level document, internal audit, and management review.
2. Preparation of instructional media  
Course learning media consists of guidance on making laboratory management documents based on ISO 17025, internal audit video and management review. This instructional media is prepared in accordance with the ISO / IEC 17025 standard [9].
3. Implementation of lectures with role-playing and simulation methods  
Laboratory Management Lectures are held for fourteen meetings by applying role-playing methods. Learning activities begin with a learning contract, the assistance of lecture material to explain the learning scenario of role-playing and simulation planning. The next stage is the implementation of role-playing and simulation in accordance with the scenario in the learning module according to the guidance of ISO / IEC 17025. The implementation of role-playing and simulation is done in the ISO 17025 Simulation Laboratory. During role-playing and simulation activities are recorded so that the video will be used as evidence learning and achievement of competence. The materials to be used in role-playing and simulation are the making of laboratory documents of level I and II, internal audit and management review.
4. Evaluation of Results  
Evaluation of the effect on the application of role-playing and simulation method can be seen from the result of the lecture value, the achievement of competence, and the lecturer teaching performance score (NKMD) compared to that obtained in the previous year as the baseline.

## RESULTS AND DISCUSSION

### Repair Course Outline, Lecture Course Unit (SAP), and Class Module

Repair Course Outline, Lecture Course Unit (SAP) and lecture module are the preparation stage for the application of the role-playing method in the subject of Laboratory Management. Improvements made is to add lecture activities previously performed in the classroom into a role-playing activity conducted in the laboratory. Role-playing activity is done in groups with assistance by lecturers and assistants. The number

of meetings that apply the method of role-playing four times with three materials is the writing of quality documents, internal audit, and management review. The material to be performed is summarized in the lecture module. The making of lecture module is based on SNI ISO / IEC 17025: 2008 on General requirements of laboratory competence of testing and calibration laboratory. In addition, the lecture module contains scenarios that students will perform in the role-playing and learning simulation [10].

**Implementation of Lecturer by Role-playing Method and Simulation**

The implementation of lecture with role-playing and simulation method is done after the exposure of the material in class. The simulated material is the creation of quality documents, internal audits, and management reviews. Implementation of role-playing and simulation method is started with scenarios by lecturers and presentation of scenarios to students. Scenario making is based on lecture material and ISO 17025 as the source of the material and SKKNI Field of Laboratory Testing Service as its assessment parameter. The relationship between lecture materials, scenarios, ISO 17025 and SKKNI Field of Laboratory Testing Services can be seen in Table 2. In Table 2. can be seen in the document-making material, the scenario is made based on ISO 17025 for all clauses and SKKNI Field of Laboratory Testing Services for all MSL on quality testing, it is based on quality documents of level I and II should cover the subject of internal audit and management review. As for the internal audit material and management review based on specific clauses in ISO 17025 and MSL specific also on SKKNI Field Testing Services Laboratory. Submission of role-playing scenarios was conducted in group discussion, i.e. the students were divided into small groups (5-7 persons) and accompanied by 1 assistant. This is done so that there is a common perception between the material scenarios and students' minds. The number of students in one group should not be too much because it can cause the transfer of student scenarios information is not optimal. In the discussion group, the students are asked to simulate the activity based on the scenario accompanied by the assistant, the assistant here is in charge as the controller when the student simulation is not in accordance with the expected scenario so that when doing the role-playing there is no significant error. After the guidance of understanding the material of the scenario, the students perform role-playing independently, the result is collected in the form of writing (document) or video.

**TABLE 2.** The relationship between the lecture scenarios to ISO 17025 and SKKNI

Source Scenario	Course material	Correlation with SKKNI
ISO 17025 clause 1-5	Making Documents Level I and II	MSL 91600A Develops and maintains laboratory documents MSL 933002A Contributing to the achievement of quality objectives MSL 934002A Implementing quality systems and continuous improvement processes MSL 936001A Maintain quality systems and processes in a sustainable improvement in the working environment MSL 936002A Conducting internal audits of the quality system
ISO 17025 clause 4.14 About Internal Audit	About Internal Audit	MSL 936002A Conducting internal audits of the quality system
ISO 17025 clause 4.15 On Internal Audit About Management Review	On Management Review	MSL 933002A Contributes to the achievement of quality objectives MSL 934002A Apply quality system and continuous improvement process MSL 936001A Maintain a continuous quality system and process improvement in the work environment

On document-making materials, students are directed to create a testing laboratory where they play the role of top managers, quality managers, technical managers and analysts and make the laboratory quality documents based on the scope chosen. This document-making material was conducted twice in a meeting producing a laboratory quality document. The next material is the internal audit, of this material, the student playing role (role-playing) as auditor and auditi from laboratories that have been made the document at the previous meeting. Here students are taught to assess the results of their own work. In the last material of the management review, students play roles in review meetings that discuss the results of the internal audit, problems that exist in the laboratory and its completion. Management review teaches students to recognize the problems in the laboratory and the settlement steps in both the short and long term. Students are also given the task of making the video about the implementation of internal audit and management review. The video created has a minimum standard of activity that must exist, for internal audit of activities that should be documented is Planning; Opening Meeting; Investigation; Analysis of findings; Reporting; Follow-up in the form of corrective action; and Closing Meeting. As for the review of the parameters management that must be in the video made is Preparation of material resources management review; Input for management review; Output from management review; and Follow-up management review. Based on the result of the video made by the student, it can be seen that the students understood the context or parameters that exist in the implementation of internal audit and management review but still not developed the material displayed, the material created by the video is still based on the auxiliary material of the learning activity in laboratories, students have not been able to develop the findings and problems and steps solving.

The results of the application of role-playing and simulation on Laboratory Management contributed to the development of methods, strategies, media, and evaluation of learning, especially on vocational school education programs or professional education programs. Course Outline Improvement, SAP, a learning module with role-playing and simulation can be an alternative to an effective and fun course that can be used as a model for other courses. The application of role-playing can increase students' self-confidence to show themselves that they understand the course material. The learning method of role-playing can be continued in the next course because it gives a positive impact. For the next course, it is expected that the role-playing method can be applied to more material not only document creation, internal audit, and management review.

### Evaluation of Results

The effect of the application of role-playing and simulation method to the students can be seen from self-assessment, the final score, and lecturer questionnaire.

#### 1. The effect of role-playing on the results of self-assessment

Self-assessment is used to perform self-assessment by students on the achievement of student competence on performance criteria. Preparation this independent assessment is based on the competency unit in SKKNI Field of Laboratory Testing Services. There are five units of competence applied:

- i. MSL91600A Develop and maintain laboratory documents
- ii. MSL933002A Contributes to the achievement of quality objectives
- iii. MSL934002A Apply quality system and continuous improvement process
- iv. MSL936001A Maintain quality system and continuous improvement process in work environment
- v. MSL936002A Implement internal audit of quality system

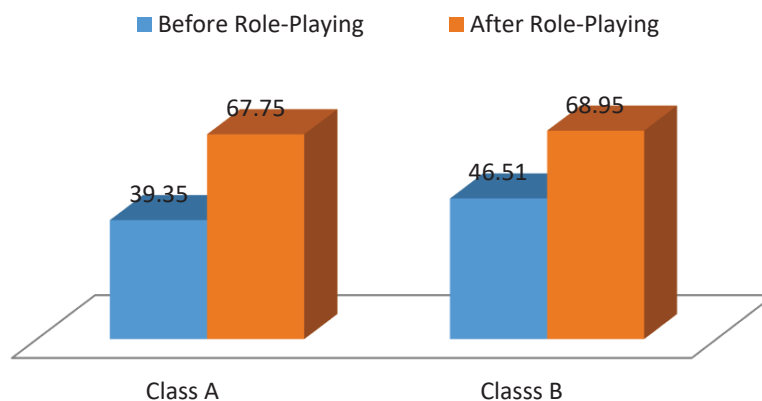
In each competency, the unit consists of several elements of competence and performance criteria (KUK). Each performance is assessed in terms of points from one to four where the greater the point the greater the student's competence in the performance criteria. The value of the achievement of each student's competence is obtained from the self-assessment of each student based on the Formula 1:

$$\text{The value of achieving individual competencies} = \frac{\text{number of points selected}}{\text{number of maximum points}} \times 100 \quad (1)$$

This self-assessment is done twice before the learning activity of role-playing and after role-playing. This is done to determine the effect of the application of role-playing. Furthermore, the average value of the achievement of student competence per class from the value data achievement of individual competencies with the Formula 2:

$$\text{The average value for each competency achievement} = \frac{\text{number of individual achievement values in 1 class}}{\text{number of students in 1 class}} \quad (2)$$

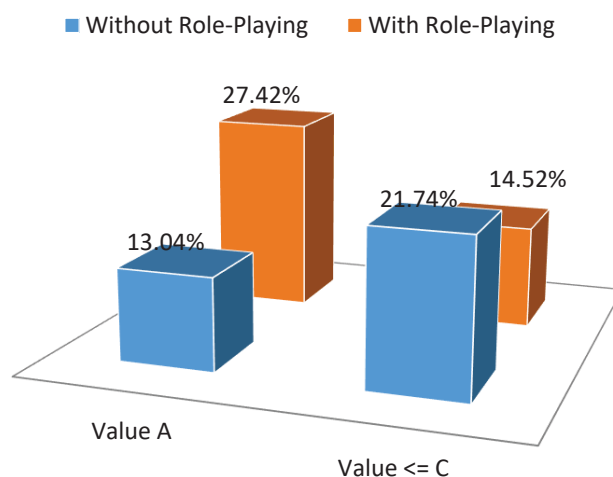
The average value of the achievement of each class's competence before and after the role-playing can be seen in Figure 1. In Figure 1. it can be seen that after applying role-playing there is an increase in the average score of achievement of student competence in both Class A and Class B. In class A, the average achievement of student's previous competence was 39.35% and increased to 67.75% and class B increased from 46.51% to 68.95%. These results indicate that the higher the students rate themselves competent after the role-playing on learning activities. So it can be said that the application of role-playing in course can increase students' self-confidence in understanding the course material.



**FIGURE 1.** Results of Self-Assessment/*Self-assessment* before and after the *role playing*

## 2. The effect of role-playing to on improving in student value

The influence of role-playing on the improving of student value is seen from the number of students who get A and students who got the C value down. The value is compared with the value in the previous semester that did not apply role-playing. The influence of role-playing on the increase of student value can be seen in Figure 2. In Figure 2. it can be seen that there is an increase in the number of students who got an A score of 13.04% rose to 27.42% while the number of students who got  $\leq C$  decreased 7, 22% from 21.74% to 14.52%. The decrease in the value of  $\leq C$  is not in accordance with the previous target of 10%, this is because not all the lecture material is done by the role-playing method so that not all the material can be correctly understood by the students.



**FIGURE 2.** The Effect of *Role-Playing* to Total Value A and C  $\leq$  of Student

### 3. The effect of role-playing on lecturer questionnaire

The effect of applying role-playing to lecturer questionnaire can be seen in Figure 3. In Figure 3. we can see the increase of lecturer questionnaire value from 3.36 to 3.43. The increase was not significant only increased 2.08%. The existence of this lecturer questionnaire score shows that the application of role-playing has a positive impact on the teaching performance of lecturers. This is because in the application of role-playing in the lecture will make the emotional closeness between lecturers and students so that the learning atmosphere is felt fun by the students.

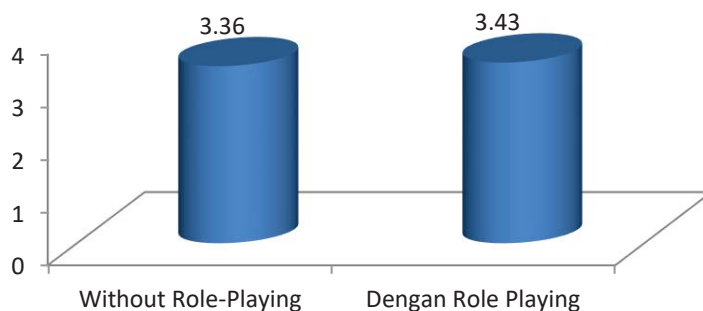


FIGURE 3. The effect of *role playing* application on lecturer questionnaire

## CONCLUSION

The conclusions obtained after the application of role-playing in the Laboratory Management course are as follows:

1. The application of role-playing can increase students' self-confidence to show themselves that they understand the course material.
2. The existence of the practice in understanding the lecture material can increase the percentage of value A and reduce the percentage value  $\leq C$ .
3. A fun and new learning atmosphere in applying role-playing to lectures will improve the lecturer's teaching performance appraisal by students.

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