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Effectiveness of Authentic Assessment: Performances, Attitudes, and Prohibitive Factors

Wahyu Budi SABTIAWAN[1], Leny YUANITA[2], Yuni Sri RAHAYU[3]

[1] Research Assist. (lecturer), Math. Sci. Edu. Dept., Universitas Negeri Surabaya, INDONESIA, ORCID ID: 0000-0001-9503-1229
[2] Prof. Dr. (lecturer), Math. and Sci. Faculty, Chem. Dept., Universitas Negeri Surabaya, INDONESIA, ORCID ID: 0000-0002-2077-0462
[3]Dr. (lecturer), Math. and Sci. Faculty, Bio. Dept., Universitas Negeri Surabaya, INDONESIA, ORCID ID: 0000-0002-29771162

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ABSTRACT

Authentic assessment is an alternative assessment forcing students to perform like a professional in a real work-place. In other words, this type of assessment trains students to be successful-performers in professional jobs. The purpose of this study was to evaluate the effectiveness of authentic assessment based on three elements including students' performance, students' attitudes, and prohibitive factors in authentic assessment implementation. The participants were 37 Indonesian students who studied in a university and enrolled in spectroscopic methods of analysis subject. To achieve the goal of the study, the researchers used a mixed methods design. The data were gained through three techniques including, observation, test, and interview. The findings informed that the learning constructed through the authentic assessment dimensions was effective to facilitate students' performance and foster students' attitudes positively. The prohibitive factors were the difficulty of gaining motivation and enjoyment of the students at the first meeting. The results of this study implied that the authentic assessment was able to scaffold the students to achieve what they need in the future.

Keywords: Authentic assessment, student's performances, attitudes, prohibitive factors.

INTRODUCTION

Unemployment in Indonesia has been high. A total number of unemployed people in August in 2018 reached 14.15 million. The surprising thing was that university graduates contributed 11.65% of the total unemployment (BPS-Statistics Indonesia, 2018). It is partly due to the difficulties that graduates face to reach successful performance in the world of work. In addition, there is a gap between what educators require of students in tasks of assessment and what occurs in the real life or the world of work (Boud, 1990). Therefore,

Corresponding author e-mail: wahyusabtiawan@unesa.ac.id

Gulikers, Bastiaens, Kirschner, and Kester (2006) revealed that successful performance in this society need to integrate knowledge, skills and attitudes to solve problems that have many possible solutions. Traditional learning, teaching, and assessment are not able to fulfill such requirements.

In a particular, many educators in Indonesia still consider assessment as only "Assessment of Learning (AoL)." In other words, they still use traditional assessment. Traditional assessment tends to assess students based on tests' standardized objective items that have single right answers (Herrington & Herrington, 2006). This perspective views the assessment is a tool to measure the quality of the product conducted by educators (Sabtiawan, 2018). The definition is in line with Angelo and Cross (1993) explaining that assessment is utilized for checking how well students' performance at middle and end of the semester. In other words, the AoL only contributes to inform students about their achievements. With the AoL, students may lack experience in terms of self-assessment. As a consequence, the awareness of what their capabilities are and what the class expects may contravene. Then, the traditional assessment fails to develop students' abilities to perform "real world" task and positive students' attitudes.

There are two perspectives of assessment contributing to bridge the gap, namely, "Assessment for Learning (AfL)" and "Assessment as Learning (AaL)". Experts revealed that through the AfL, educators were able to advise students to improve their learning based on what they chieved (Black & Wiliam, 1998; Heyward & Hedge, 2005; Jones, 2005). Educators can provide feedback to students' works for promoting their learning and informing them regarding how to revise their works at a better level. Arguably, the paradigm of assessment may lead the educators to give positive impacts to the students' learning through the assessment. The argumentation is in line with the finding of researchers explaining the AfL affected positively on the students' performance in higher education (Hidayati, Sabtiawan, & Subekti, 2017; Setiawan & Sabtiawan, 2017). Therefore, educators should consider the implementation of the AfL in terms of the influence of this assessment type on learning.

The AaL is a type of assessment approach viewing the assessment as a foundation for the educators to construct teaching and learning activities. Earl (2012) explained that the AaL occurs when students manage and evaluate their learning, and use the feedback to determine what they have to do. In other words, the AaL can stimulate meaningful learning. The meaningful learning occurs when students are actively engaged in their learning (Mayer, 2010; Novak, 2002). In addition, the students will experience of doing self-assessment. As cited in Leach (2012), self-assessment has been more beneficial than teacher assessment in terms of enhancing learning, preparing students for a democratic society, providing self-control toward their assignments, developing students' metacognitive skills, promoting active learning, forcing thoughtfulness on assignments, increasing students' understanding on assignments, decreasing conflicts between students and teachers, and enhancing students' intellectual and social competencies. Additionally, students can learn through the assessment when the educators implement AaL. As a consequence, the students can work on their assignments based on educators' expectations.

The consideration of the two perspectives of assessment will be an essential aspect for educators for helping their students to achieve successful performances in their future. There is an alternative assessment that can accommodate the two perspectives, namely, authentic assessment. It is an assessment method enabling students to integrate their knowledge, skills and attitudes as professional need in the real world (Gulikers et al., 2006). Cumming and Maxwell (1999) classified authentic assessments as performance, context, complexity, or competence.

According to Rule (2006), there are four characteristics of authentic assessment in higher education, that are (1) involving real-world problems that mimic the work of

professionals, (2) including open-ended inquiry, thinking skills, and metacognition, (3) engaging students in discourse and social learning, and (4) empowering students through choice to direct their learning. These characteristics not only help recognize an authentic assessment but also help provide theoretical constructs to describe significant elements or properties of authentic assessment.

Gulikers, Bastiaens, and Kirschner (2004) explained that the authentic assessment has five dimensions to represent its authenticity, which are, tasks, physical context, social context, assessment result or form and criteria. Task means an authentic task that engage students within activities conducted in real life situation as professional practice. Physical context is related to place and time like professional in the real world. Social context is also considered in authentic assessment. In real life beyond the school, professionals work cooperatively in a team. Assessment result or form means authentic assessment assess the product produced by students. In other words, the authentic assessment assesses students' performances. Criteria mean the requirements that should be fulfilled by the students. The criteria of an authentic assessment can also be based on the interpretation of the other four dimensions (Gulikers et al., 2004).

There is educational research that relates to authentic assessment. Herrington and Oliver (1999) conducted a qualitative research study in which they used situated learning and multimedia to investigate higher-order thinking. One element of the situated learning is authentic assessment. The results of the research study showed that the majority of thinking of students in terms of doing tasks was higher order thinking. Moreover, the authentic assessment provides opportunities for deep learning (Gulikers et al., 2006). Therefore, through their dimension, authentic assessment can provide meaningful learning and students can be encouraged to be successful performers as they can relate their learning to the real world situations. The previous research clearly showed that the educators had difficulties to arrange phases of learning and found this approach as time consuming. In this research, an authentic assessment will be modified and applied in learning cooperatively in order to avoid waste of time.

Based on the explanations above, this research evaluates the effectiveness of authentic assessment on students' performances, attitudes, and prohibitive factors during learning. We conducted this research at higher education in spectroscopic methods of analysis subject. This subject has been essential to choose in this research because it was mainly utilized by industry to characterize the composition of matter. Therefore, we hoped students to achieve successful performances in this subject.

Research Problem:

The main research problem of this study was "How was the effectiveness of authentic assessment on students' achievement?" The problem is detailed into three questions.

1. What were the students' performances during the implementation of authentic assessment and the factors affecting them?
2. What were the students' attitudes toward learning spectroscopic methods of analysis subject during the implementation of authentic assessment and the factors affecting them?
3. What are the prohibitive factors that appeared during the implementation of authentic assessment?

METHODS

This study implemented a mixed methods design to examine the research questions. A mixed methods research design is a procedure for collecting, analyzing, and "mixing" both quantitative and qualitative methods in a single study or a series of studies to understand a

research problem (Creswell & Plano Clark, 2011). The basic assumption is that the uses of both quantitative and qualitative methods, in combination, provide a better understanding of the research problem and question than either use of the method by itself. The type of mixed method was a triangulation mixed method design (Jick, 1979; Mathison, 1988; Mertens & Hesse-Biber, 2012; Sandelowski, 2000). The design is pictured in Figure 1.

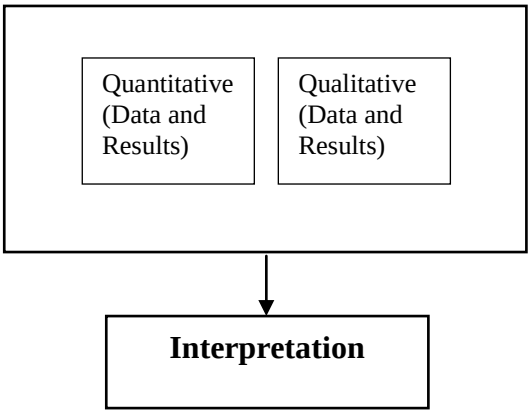

Figure 1. The design of triangulation mixed methods

The Figure 1 describes that the quantitative and qualitative data are combined and integrated each other to construct an interpretation.

a) Participants

The researcher chose one undergraduate chemistry class of Chemistry Department consisting of 37 students, Universitas Negeri Surabaya (Unesa) as research participants. The students were still at the program of spectroscopic methods of analysis subject.

b) Techniques of Data Collection

This research used several ways to collect the data so that the researchers used both quantitative and qualitative data. The quantitative data were obtained through observation and test while the qualitative data were yielded through observation and interview.

c) Research Procedures

The implementation was carried out through two procedures, namely, research and teaching procedures. Both procedures were conducted simultaneously. The research procedures contained the implementation of data collection techniques. The research procedures were conducted for six sessions. Observation and research diary were conducted in every session, especially from the first to fourth session. The researchers observed the students' activities by using research diaries (i.e., taking notes). At the fifth session, the researcher collected the quantitative data using a rubric to assess project report and students' presentations. In the last meeting, an achievement test was utilized and researchers conducted the focus group interviews. Interviewees were selected based on the score of students' performance, as explained in the instrument and data collection section. For the teaching procedure, we followed the procedures of cooperative learning involving clarifying and setting goals, presenting information, organizing students in learning teams, assisting group work and study, testing the materials, and providing recognition. In addition, the teaching and learning activities were constructed based on the five dimensions of the authentic assessment, as written in Table 1.

Table 1. *Manifestation of authentic assessment dimensions*

No.	Dimensions of Authentic Assessment	Manifestation
1.	Authentic tasks (there are ten elements)	
	a. Authentic tasks have real-world relevance.	• The task encourages students to do analysts' jobs in the real work place. • The task encourages students to develop abilities that are needed in the real world, such as writing and oral communication.
	b. Authentic tasks are ill-defined.	• The students are only provided simple instruction without detail steps or procedures, such as work sheet. Hence, the students have the opportunity to determine their design or relevant action by themselves.
	c. Authentic tasks needs over a sustained period of time.	• The task will be completed within five meetings rather than one meeting only because the task is complex.
	d. Authentic tasks provide the opportunity for students to examine the task from different perspectives.	• Students are given the opportunity to search for information from many resources, such as references from books or websites. Thus, they will have various perspectives. • Students are engaged in collaborative activities.
	e. Authentic tasks provide the opportunity to collaborate.	• The task needs to be completed in groups. • Students' performances are scored based on team's performance.
	f. Authentic tasks provide the opportunity to reflect.	• Encouraging students to perform like an analyst provides opportunities for them to reflect their own experience beyond the school. • The task encourages students in collaborative activities; thus, they can reflect their abilities to the rest of group members.
	g. Authentic tasks can be integrated and applied across different subject areas and lead beyond domain-specific outcomes.	• The task encourages students to integrate chemistry knowledge, writing and communication skill.
	h. Authentic tasks are integrated with assessment.	• The task will be assessed by using rubrics for project report and oral presentation.
	i. Authentic tasks create a holistic product.	• The students do complete action involving analysis a sample, construct the report and communicate the report.
	j. Authentic tasks allow competing solutions and diversity of outcome.	• Students are given more opportunities to search for information from many resources, such as references from books or websites rather than only follow the fixed worksheet. • The task allows the diversity of outcomes through project report and oral presentation.
2.	Physical context	• Student learning is conducted in the classroom. • Students will complete the task in the laboratory.
3.	Social context	• Students need to complete the task in team.
4.	Assessment result or form	• Rubric for project report and oral presentation are employed to assess students' performances.
5.	Criteria	• Criteria should be fulfilled by the students based on the other dimensions.

d) Techniques of Data Analysis

In this study, we used some analysis techniques adapted from Yin (2017) and Merriam (1988). The first is clustering or categorizing. The clustering or categorizing refers to the grouping together the data that appear similar (Merriam, 1988). In this research, we categorized the data based on the research questions; thus we had three groups of data;

including students' performances, attitudes, and prohibitive factors of authentic assessment implementation. We also took some notes and comments in the margins of research diaries to categorize and make the data more meaningful during the categorization of the data. The second is factoring. The factoring means a process to reduce a large data into focused data. The factoring occurred simultaneously with categorizing in this study. The last is combining qualitative and quantitative data. In this research, the analysis was not only based on the qualitative data that come from observation and interview but also the quantitative data supported the analysis especially related to the students' performances.

FINDINGS

In the present study, there were three results sections including assessment results of the authentic task (student's performance based on the authentic task), interview results, and research diary results. Each result section is elaborated in more detail in the followings.

a) Students' Performance

Assessment Results of the Authentic Task

Students' performance on the authentic task relates to project reports and oral presentations. The possible highest total score of them is 100. The contribution of the project report was a total score of 60 and the presentation was a total score of 40. Both tasks were assessed using a rubric and the results of these tasks are shown in Table 2.

Table 2. *Results of students' performances on authentic task*

Assessment forms	Aspects of assessment	Score								
		G.1	**G.2**	**G.3**	**G.4**	**G.5**	**G.6**	**G.7**	**G.8**	**G.9**
Project report	Purpose	5	5	5	5	5	5	5	5	3
	Theoretical underpinning	8	5	5	10	3	5	8	8	10
	Procedure and Data reporting	15	3	8	3	15	3	12	15	15
	Analyzing	10	20	15	15	15	10	20	15	20
	Conclusion	5	5	5	3	5	5	5	5	3
	Reference	4	4	4	5	5	5	4	5	5
	Organization	5	5	5	4	4	5	4	5	5
Oral presentation	Subject knowledge	15	15	15	20	15	15	10	10	15
	Visual	5	4	5	5	4	4	4	4	5
	Eye contact	5	5	4	4	4	4	4	4	5
	Team work	5	5	5	4	4	4	4	5	4
Total Score		**82**	**76**	**76**	**79**	**79**	**65**	**80**	**80**	**90**
Alphabetical Score		**A-**	**B+**	**B+**	**B+**	**B+**	**B-**	**A-**	**A-**	**A**
Explanation		**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**

By transforming the scores of the groups into alphabetical grades that the university possesses (See Table 2), the sixth group (G.6) received a grade of B-; the second (G.2), third (G.3), fourth (G.4), and fifth group (G.5) received a grade of B+; the first (G.1), seventh (G.7), and eighth (G.8) received a grade of A- whereas the ninth group (G.9) received a grade of A. This result represents that all students passed the subject for the particular topic. The percentage distribution of the alphabetical grades are presented in Figure 2.

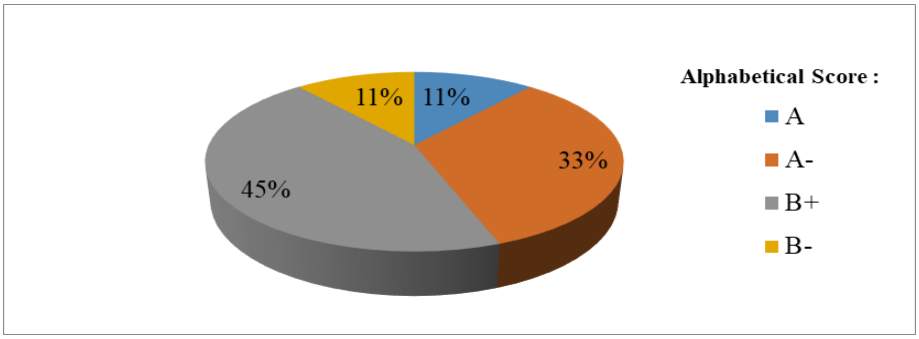

Figure 2. Diagram of achieved alphabetical score in percentage form

As seen in Figure 2, no group received a grade of B, C+, C, D, and E. Thus, it was considered that the four groups of students had good concept of atomic absorption spectroscopy and skills.

Interview Result Concerning Student's Performance

The purpose of the interview results was to support the discussion about students' performance. The interviewees included students with low level performance, students with middle level performance, and students with high level performance. Table 3 presents the interview results regarding students' performance.

Table 3. *Interview Result Concerning Student's Performance*

Questions	**Interviewees**		
	Students with low level performance	**Students with middle level performance**	**Students with high level performance**
What is your opinion about the effect of authentic assessment implementation on your performance?	*… we got explanation theory at the first and then implemented it through the project… this way affected our performance positively and mastery of the topic was deeper.*	*… it is very useful for our performance improvement because the theory and project were discussed and prepared well before…*	*… Our performance in term of constructing project report and doing presentation were increasing positively because there was a discussion…*

Based on the results of the interview, as seen in Table 3, it can be summarized that the students felt their performances were affected positively. They felt their concept mastery and their performance on authentic task got positive impacts through the learning process.

Research Diary Result Concerning Students' Performance

The purpose of research diary results was to support the discussion about students' performance. Table 4 informs the results of the research diary regarding students' performance.

Table 4. *Research diary result concerning student's performance*

No.	**Date**	**Notes**
1.	September 20th, 2013	• "After the students had been forced, the learning ran quite well and all groups were starting to contribute in the discussion. In the other side, the four groups followed the learning dominantly. (P4)
2.	October 2nd, 2013	• "They presented the design and they discussed each other. During the discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P8) • "I enhanced the students to discuss the theoretical aspects, and then some groups gave rise discussion related to the theoretical aspects. It is essentially needed to

No.	Date	Notes
		cover their mastery about the concept of atomic absorption spectroscopy." (P9)
4.	October 25th, 2013	• "Each group presented their draft and they discussed each other. During the discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P17)
5.	November 6th, 2013	• "Each group presented their final report and they discussed each other. During the discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P21) • "All groups were active during the learning through presentations." (P22)

According to phenomena (P) in Table 4, it can be said that the students became successful as active learners. The students shared information with each other through presentations. In addition, they contributed ideas and posed questions during learning.

b) Students' Attitudes

To examine the students' attitudes, we used three research results including results of research diary, interview, and affective ability observation. Each result section is elaborated in more detail in the followings.

Research Diary Results Concerning Students' attitudes

The purpose of the research diary results was to support the discussion about students' attitudes. As indicated in Table 5, the students showed positive response to the learning (authentic assessment with embedded cooperative learning). They got their enjoyment and interest during the learning, as stated in the quotes P5, P8, P10, P14, P17, P19, P21, and P23.

Table 5. *Research diary result concerning student's attitudes*

No.	Date	Notes
1.	September 20th, 2013	• "The class also showed good respond when I explained the task. They asked some questions related to the task, seemed had good motivation, and interested enough." (P5)
2.	October 2nd, 2013	• "They presented the design and they discussed each other. During the discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P8) • "In this meeting the students started to pose questions and ideas without forcing. On the other hand, there were some groups still seemed not confidence to pose questions and ideas" (P10)
3.	October 18th, 2013	• "The learning condition in the laboratory tended to noisy but they seemed to enjoy their practicum." (P14)
4.	October 25th, 2013	• "Each group presented their draft and they discussed each other. During the discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P17) • "In this meeting the students posed questions and ideas without forcing." (P19)
5.	November 6th, 2013	• "Each group presented their final reports and they discussed each other. During the discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P21) • "In this meeting the students posed questions and ideas without forcing." (P23)

Interview Result Concerning Students' Attitudes

The purpose of the interview results was to support the discussion about students' attitudes. The interviewees involved low, middle, and high level performance students.

Table 6. *Interview result concerning student's attitudes*

No.	Questions	Interviewees		
		Students with low level performance	**Students with middle level performance**	**Students with high level performance**
1.	How about your motivation during this learning?	*We got motivation to follow the learning because we learned like an analyst… Discussion and presentation were able to motivate…*	*We were motivated to learn this topic because of this learning way I got*	*… the discussion showed our weaknesses so that we were enhanced or forced to refine it…*
2.	What is your interesting toward this topic after the implementation of authentic assessment?	*… we learned this topic through discussion… We learned like an analyst so that it was appropriate with our future*	*We were interested in it because if there was a problem or discussion, we discussed and synchronized it with several aspects (theory and practice).*	*We felt interested in this topic because by using this method we were not boring to listen to the lecturing dominantly but we were hoped to be active in this learning*
3.	What is your enjoyment during this learning?	*We got the enjoyment during learning… there was synchronized between theory and practice so that it was unforgettable.*	*Initially we were uncomfortable… it was different from our habit. Then, I felt enjoy because we learned in a team.*	*… I could share information with my friends in a group and other groups without reluctance.*

Table 6 shows the result in more details. Based on the interview results, it can be said that students got enjoyment and interest during the learning although they felt uncomfortable at the first moments. They argued that their learning way was able to promote their enjoyment and interest.

Results of Affective Abilities Observation

Affective abilities relate to the students' behaviors during learning. In this research, the affective abilities were only focused on working collaboratively, posing ideas, and posing questions.

Table 7. *Results of observation of affective abilities*

Student group	Score of achievement							
	1st meeting		2nd meeting		3rd meeting	4th meeting		5th meeting
	Posing idea	Posing question	Posing idea	Posing question	Work collaboratively	Posing idea	Posing question	Posing question
G.1	3	3	3	4	4	4	4	4
G.2	2	2	2	4	4	4	3	4
G.3	4	2	3	3	4	3	3	4
G.4	2	2	2	2	3	4	4	3
G.5	3	2	2	3	4	4	4	3
G.6	3	2	3	2	3	3	3	3
G.7	2	2	2	3	3	3	3	3
G.8	4	3	3	3	4	4	4	3
G.9	4	2	4	3	4	4	4	4
Total score	27	20	24	27	33	33	32	31
Number of group	9	9	9	9	9	9	9	9
Average score	3.00	2.22	2.67	3.00	3.67	3.67	3.56	3.44
Achieve Ment level	**Good**	**Need improve ment**	**Need improve ment**	**Good**	**Excellent**	**Excellent**	**Excellent**	**Good**

(**Criteria:** 1.00 – 1.99 = Unacceptable; 2.00 – 2.99 = Need improvement; 3.00 – 3.49 = Good; 3.50 – 4.00 = Excellent)

Table 7 informs that the achievement level of posing question decreased (from excellent to good level) during observation of meeting 4 (presentation of project report draft) and 5 (presentation of final project report). It was because the concepts and their difficulties dominantly were discussed in the meeting 4. Hence, the side effect was the decreasing number of students' questions in the meeting 5. This effect cannot be said a negative effect for students' learning because the students were prepared well in the meeting 4 so that it was assumed that they understood the concept and solved their difficulties dominantly in the meeting 4. Therefore, they were more confident into the actual presentations in the meeting 5.

c) Prohibitive Factors

To evaluate the prohibitive factors, we also used three research results, which are, research diary results, interview results, and observation results of lesson plan implementation.

Research Diary Results Concerning Prohibitive Factors

The purpose of the research diary results was to support the discussion about prohibitive factors. Table 8 informs the result as follows.

Table 8. *Research diary results concerning prohibitive factors*

No.	Date	Notes
1.	September 20th, 2013	• "All students attended the class. When I entered the class, the students seemed nervous or even confuse because they talked to each other about that day lecturing. Probably, they thought what and how they will learn." (P1) • "On the other hand, I needed to force them (almost all groups) in terms of asking questions and posing ideas. There were only four groups (group 1, 3, 8, and 9) that posed question and idea without my forcing." (P3)

Table 8 informs that the students seemed nervous and stress at the first moments. In other words, active learning was still not usual yet at the beginning so that the students did not get their enjoyment yet at the first moments as stated in the quotes P1 and P3.

Interview Results Concerning Prohibitive Factors

The purpose of interview results was to support the discussion about the prohibitive factors. The interviewees involved low, middle, and high level performance students.

Table 9. *Interview result concerning prohibitive factors*

No.	Questions	Interviewees		
		Students with low level performance	**Students with middle level performance**	**Students with high level performance**
1.	Please, give me your explanation about the implementation of this method during the lesson!	*The implementation of this method during the lesson was good… I hope the meeting is tighter in a week (twice in a week) but it will need to adjust the schedule.*	*The implementation of the project in the laboratory should be arranged in a better way. The condition was too crowded.*	*… I suggest that in order to give the initial information about AAS, the video about an analyst using AAS is needed to present at the first moment (not only picture).*

No.	Questions	Interviewees		
		Students with low level performance	**Students with middle level performance**	**Students with high level performance**
2.	How is your perception if this method is implemented in the future at the same topic?	*… it can be better to implement in the future. It needs to adjust the schedule…*	*It can be implemented even for other topics…*	*It is possible to do because this method is able to force the students as active learner…*

As seen in Table 9, the students indicated that the meetings needed to be adjusted in tighter (twice in a week), the condition of laboratory during doing projects was too crowded so that it should have been arranged in a better way, video about AAS should have been provided at the first moment, and the method of learning was possible to implement in the future at the same topic.

Observation Results of Lesson Plan Implementation

This observation focused on how far the lesson plan was successfully and completely done in class. In other words, the result of this observation was as a mirror the quantity and the quality of the lesson plan implementation. Table 10 informs that scenarios in each phase were implemented in excellent and good levels.

Table 10. *Observation results of lesson plan ımplementation*

Phase of the learning	Assessed Aspects	Score		Average Score	Level/ Category
		Observer 1	Observer 2		
Phase 1: Clarify goals and establish set.	Motivating students and asking prior knowledge of students	3	3	3	Good
	Motivating students to pose idea	4	4	4	Excellent
	Giving information of learning objectives	4	4	4	Excellent
Phase 2: Present information.	Presenting basic knowledge briefly	3	4	3.5	Excellent
	Guiding students to pose idea and questions	4	4	4	Excellent
	Communicating authentic assessment	4	4	4	Excellent
Phase 3: Organize students into learning teams.	Organizing students in group	3	4	3.5	Excellent
	Communicating authentic task	3	3	3	Good
	Providing some example of analysis using AAS	4	4	4	Excellent
	Determining the project	4	4	4	Excellent
	Providing opportunity to the students for designing their experiment	3	4	3.5	Excellent
Phase 4: Assists teamwork and study.	Asking each group to present their design of project	4	3	3.5	Excellent
	Motivating students to pose idea and questions	3	3	3	Good
	Giving feedback to each group	4	4	4	Excellent
	Conducting the project	4	4	4	Excellent
	Announcing to the students about laboratory safety	3	3	3	Good
	Giving opportunity the students to conduct their project	3	4	3.5	Excellent
	Asking the students to record the result	3	3	3	Good
	Having the students to present their draft of project report	4	4	4	Excellent

Phase of the learning	Assessed Aspects	Score		Average Score	Level/ Category
		Observer 1	Observer 2		
	Motivating students to pose idea and questions	3	4	3.5	Excellent
	Posing questions to each group	3	3	3	Good
	Giving feedback to each draft	4	4	4	Excellent
Phase 5: Tests on the materials.	Asking the students to present their final project report	4	4	4	Excellent
	Motivating students to pose questions	4	3	3.5	Excellent
	Posing questions to each group	4	4	4	Excellent
	Giving feedback	3	4	3.5	Excellent
Phase 6: Provide recognition.	Guiding the students to summarize	4	3	3.5	Excellent
	Providing group reward	4	4	4	Excellent

(**Criteria:** 1.00 – 1.99 = Unacceptable; 2.00 – 2.99 = Need improvement; 3.00 – 3.49 = Good; 3.50 – 4.00 = Excellent (based on Arikunto (2011))

It seemed that the lesson plan was successful to bring the authentic assessment with embedded cooperative learning to class. However, there were aspects still needed to be concerned for further implementation of the lesson plan such as motivating students. These aspects may have impacted students' learning. Further discussion will be brought in Discussion Section.

Knowing that six phases of the lesson plan consisted of 28 steps of assigning teaching and learning packed as scenarios, the implementation of that was 100% because all steps were implemented. Such percentage was calculated by dividing the number of implemented aspects over the total number of observed aspects and then multiplied by 100%.

DISCUSSION and CONCLUSION

a) Students' Performance

In the authentic task, the students did the task adjusted to the real work place. They conducted a project. To represent the result of the project, the students needed to construct a project report and then communicated it with each other. Thus, there were two assessed categories (i.e., project report and oral presentation). In order to overcome subjectivity in the assessment, each category was assessed by using a rubric. All groups gained scores above the minimum requirement to pass the subject matter (based on Unesa standard score). There were three groups that received excellent scores. It can be said that this learning affected the students' performance positively. In other words, the authentic assessment facilitated the students' performance. Students' statements in the interview supported this results.

"… this way affected our performance positively…" (low performance student)

"… it was very useful for our performance improvement…" (middle performance student)

"… Our performance in term of constructing project report and doing presentation were increasing positively…" (high performance student)

This fact can be explained using several reasons. Each reason is discussed in details below.

Firstly, the students were always provided with opportunities to discuss each other. The discussion was promoted through one of the authentic assessment dimensions, that is, social context. Through the discussion that was noted in the research diary, the students got useful suggesstions to improve their work. This reason is also in the same line with the students' perspectives below.

"Through discussion, we got corrections or inputs that were very useful…" (low performance student)

"… Our performance in term of constructing project report and doing presentation were increasing positively because there was discussion… the discussion showed our weaknesses…" (high performance student)

In other words, the students received some feedbacks. There were many reviews stated that feedback was needed by students during their learning. As cited Woolfolk (2008), feedback emphasizing progress is the most effective because when the feedback highlighted accomplishment, the participants' self-confidence, analytic thinking, and performance were all enhanced. The flow of discussion during learning was student-student-lecturer-student. This occurred because we wanted the students to do corrections through themselves and their friends. Posing ideas and questions from students were at the good and excellent levels. Thus, they did not only get immediate feedback but also delayed feedback. Schooler and Anderson (1990) found that delayed feedback is more beneficial to detect self-errors at which it may benefit to students becoming independent learners and being able to learn as self-concept explorer.

Secondly, the students received a good preparation. Based on the guideline, the groups presented their design (meeting 2) before doing the project (meeting 3), presented their draft (meeting 4) before submitting and presenting the final report (meeting 5). The good preparation was also happening because of the third characteristic of the authentic task, that is, investigation of authentic tasks in a sustained period of time. The students were also provided two rubrics and clearly informed about the meaning of each assessment item. The result of the interview below also supports this perspective.

"… the theory and project were discussed and prepared well before…". (middle performance student)

Therefore, the students needed a good preparation for their reports and presentations. It is because they liked to before actual implementation.

Thirdly, the students collaboratively worked in the groups. The collaborative working occurred one of the authentic assessment dimensions, that is, social context. In this part, the students' performance was measured by using the authentic task so that the collaborative working was useful for doing well the task. It is because there were some perspectives toward the task that could be used to finish the task well. Joyce and Weil (1992) revealed that the shared responsibility and interaction produce a more positive feeling toward a task. It means that the students in each group had a positive feeling toward the task. Therefore, by using the collaborative working, the students could perform well on the task.

b) Student's Attitudes

This part is constructed to examine the student's attitudes toward learning the topic during the implementation of authentic assessment. We used three sources including students' perspectives through the result of the interview, research perspective through the results of the research diary, and the result of affective abilities observation. We combined the three types of data to support each other and construct a comprehensive discussion as provided below. This discussion of students' attitudes only focused on interest and enjoyment. The analysis and discussion of both focuses are elaborated in the following paragraphs.

Analysis of Students' Interests toward Learning the Topic after the Implementation of the Authentic Assessment

The interest is an attitude that is needed by everyone in term of doing something well, especially for students who learn the material or topic. It is because greater interest tends to

create more positive emotional responses to the material, then greater persistence, deeper processing, better remembering of the material, and higher achievement (Ainley et al., 2002; Pintrich, 2003; Schraw & Lehman, 2001). Moreover, greater interest, more attention toward science. As cited in Fajardo, Bacarrissas, and Castro (2019), more attention can lead students to acquire positive attitudes towards science. On the other hand, each student does not have the same level of individual interest toward the material or topic so that it is needed to promote situational interest for students. Boekaerts and Minnaert (2006) asserted that situational interest is generated in the situation itself with certain conditions or stimuli. Therefore, we discussed how the interest of the students toward atomic absorption spectroscopy topic below.

There were several indications that the students were interested in the learning. Some research diary notes as the indications of the students' interests at the phenomenon 5, 10, 19, and 23 are shown below.

> "The class also showed good respond when I explained the task. They asked some questions related to the task, seemed had good motivation, and interested enough." (P5)
>
> "…. pose questions and ideas without forcing." (P10, P19, P23)

In addition, these findings are completed by the result of affective abilities observation that presented in Table 6.

The data informed that posing questions and ideas (meeting 3-5) were in the range of good and excellent level. Through enthusiastic posing questions and ideas, the students wanted to show that they were enthusiast to get information about the topic further. It means that the students were interested in the topic by showing their good responses. Moreover, to strengthen the above indications, the result of the interview below informed that students were interested during the learning.

> "It was interesting…" (low performance student)
>
> "We were interested to it…" (middle performance student)
>
> "We felt interest in this topic…" (high performance student)

The result of the interview indicated that the three levels of students' performance also stated their reasons differently why they were interested.

There were three reasons for students' interest appeared in the result of the interview. Firstly, the students were interested because they were facilitated to learn the theory through practice as stated by a middle performance student below.

> "…we discussed and synchronized it with several aspects (theory and practice)." (middle performance student)

In this learning, the authentic task, the first dimension of authentic assessment, forced the students to practice directly in the laboratory like a professional, but the students were also forced to mastery the theory or concepts to finish the tasks well. Therefore, the students' interest level was raised through the authentic task.

Secondly, the students' interest was promoted because they were given opportunities to discuss each other intensively as stated by a high performance student below.

> "… we were not boring to listen to the lecturing dominantly but we were hoped to active in this learning…" (high performance student)

The high performance student rose the statement because of the existence of social context (one of authentic assessment dimension) and the third authentic task characteristic (authentic tasks needs over a sustained period of time (Herrington et al., 2010). Through more intense discussions, the students can get opportunities to find more information about the topic and they can be more active to speak about the topic. Hence, this process could increase the possibilities that the students found their interests in the topic.

Thirdly, their interests were increased with their engagements to the activities like the real work place as stated by a low performance student below.

"… We learned like an analyst so that it was appropriate with our future…" (low performance student)

The students' reasons for their interest rose because the authentic task was provided for the concept learning. Gulikers et al. (2004) proposed that the authentic task engages students within activities conducted in real life situations as professional practice. Thus, it is not surprising when students said "it was appropriate with our future" because students were aware that they were learning the job as they wanted. In addition, Aladejana and Aderibigbe (2007) explained that laboratory work (real work of analyst) conducted in a good environment can promote student curiosity. Therefore, the students' interest can be increased.

Based on the discussions above, the students were interested the atomic absorption spectroscopy topic after getting the stimuli. Of course, the stimuli were the learning constructed by using authentic assessment dimensions. In other words, the situational interest was promoted after the implementation of the authentic assessment.

Analysis of Students' Enjoyment during Learning the Topic

Besides the students' interest, students' enjoyment is also needed to give positive feeling toward the learning. Through the positive feeling, the students can learn the topic and do the task well without trouble. As a consequence, they can achieve the desired level of performance as high as possible.

The indications of students' enjoyment can be seen in the results of the research diary noted at the phenomenon 8, 14, 17, and 21. Also, the results of the interview strengthen those phenomena as stated below.

"We got the enjoyment during learning…" (low performance student)

"… Then, I felt enjoy…" (middle performance student)

"I enjoyed this learning …" (high performance student)

Thus, the research diary's note and the students' perspective toward their learning agree that the students enjoyed the learning while the authentic assessment was implemented.

There were three different reasons standing beyond the student's perspective in term of their enjoyment. First, the reason comes from a high performance student as revealed below.

"… I could share information with my friends in a group and other groups without reluctance." (high performance student)

The statement above informs that students' experience in discussion with others can promote their enjoyment. According to them, the difference was that they had more opportunities to share their known or unknown each other without reluctance. Their enjoyment during the discussion was also noted in the research diary as below.

"They presented the design and they discussed each other. During discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P8)

"Each group presented their draft and final report, and they discussed each other. During discussion, they seemed to start enjoying their learning because they shared information to each other without reluctance." (P17, P21)

Students had more opportunity to discuss each other because of the implementation of learning guideline constructed by using the authentic dimensions. Based on the P8, P17,

and P21, it can be seen that the students learned the topic through discussion dominantly. Therefore, it can be said that the way of learning fostered the students' enjoyment.

Second, the enjoyment of student arguably was arisen because they were not forced to master the concept in a short time. This perspective describes the success of an authentic task characteristic proposed by Herrington et al. (2010). It is that authentic tasks needs over a sustained period of time. Besides the opportunities for discussions, they were not forced all of the concepts. In addition, it could be seen from the guideline that the students were provided five meetings to discuss the concept of the topic. Hence, the students were able to learn the topic with their enjoyment and without burden or forcing their capabilities. As a consequence, they could process the concept of the topic to long-term memory. As explained by Woolfolk (2008), access to information in long-term memory requires time and effort.

Third, the perspective rose from the low performance students as stated below.

"… there was synchronized between theory and practice so that it was unforgettable." (low performance student)

It can be seen from the lesson plan that the students learn the theory of atomic absorption spectroscopy (AAS) through learning how to analyze trace metals by using AAS in the real situation. The students did not need to learn the theory and practice separately. Hence, it can be argued that the students felt enjoy because they could synchronize between the theory and practice easily without separating them. In addition, this pin point also relates to the laboratory activity. As noted in the research diary below that the activity can enjoy student.

"The learning condition in the laboratory tended to noisy but they seemed enjoy their practicum." (P14)

Likewise, Hofstein and Lunetta (2003) argued that students' attitudes move towards positive states when teachers use laboratory activities to enhance teaching. Therefore, based on this third perspective, the authentic task as one of the authentic assessment dimensions facilitated the enjoyment of student during learning of AAS topic. As cited in Areepattamannil (2012), such a case is influenced by the use of hands-on activities at which students enjoy integrating their cognitive abilities with senses and motions.

Fourth, the middle performance students purposed that they got the enjoyment because they learned in a group as stated below.

"… I felt enjoy because we learned in a team." (middle performance students)

Their perspective is in line with a statement as cited in McInerney and McInerney (2010) stating that the social interaction within groups can promote good behavior among teammates. In other words, interaction and supporting each other between teammates will strengthen the relationship between them. Especially, growing good relationship between less and more capable students is one of the important purposes of learning in a team. Hence, if a good relationship is a success to form between them, the enjoyment of learning in a group can happen.

In summary, the students' attitudes involving interest and enjoyment were promoted toward the learning of AAS topic. By reconsidering the discussion above based on the students' perspectives, research diary, and result of affective abilities observation, the learning environment can be considered as the main factor for the student's interest and enjoyment. As proposed by Fraser (2001), the learning environment has a tremendous power to affect the students' achievements; thus the effectiveness of learning can be created by the appropriate learning environment. Therefore, authentic assessment with embedded cooperative learning can create the appropriate learning environment for the students who learn AAS topic.

c) Prohibitive Factors

Although the implementation of the lesson plan was 100% based on the results of observation, we also found several obstacles during the learning. In this section, hence, we discuss the obstacles or prohibitive factors that can disturb the learning. To get discussion comprehensively, we used three sources of data including the research diary, results of the interview, and observation result of the lesson plan implementation. By using those data sources, we discuss the prohibitive factors below.

The first obstacle was that we got difficulties in promoting students' enjoyment at the initial moments. At the first meeting, the students seemed stressed when they were placed at the center of their learning. In other words, arguably they did not usually learn as active learners. It can be seen in the phenomena 1 and 3 of the research diary below.

> "All students attended the class. When I entered to the class, the students seemed nervous or even confuse because they talked to each other about that day lecturing. Probably, they thought what and how they will learn." (P1)
>
> "… I needed to force them (almost all groups) in terms of asking questions and posing idea. There were only four groups (group 1, 3, 8, and 9) that posed question and idea without my forcing." (P3)

The results of the interview also support the finding noted in the research diary as stated below.

> "Initially we were uncomfortable… it was different from our habit..." (middle performance student)

For that quote, it is actually in line with an explanation as cited in Woolfolk, et. al (2008) state; students mind that the learning does not merely encompass balanced, synchronized, and rhythmical processes. The learning also involves a huge amount of chaos and conflict that can make students feel stressful and confused. Hence, students need to adapt in order to rebalance their minds (McInerney & McInerney, 2010) towards the new learning model or situation. Based on this obstacle, it is purposed that the students' confusion and stress at the first moment could be eliminated by more optimizing the phase 1 of cooperative learning guideline.

The second obstacle we had was the difficulty to motivate the students to pose questions and ideas at the initial moments. This was also because the students did not usually learn as active learners. Motivating students need to be concerned for the further implementation of the lesson plan. McInerney & McInerney (2010) revealed that motivation is an internal condition that keeps students at tasks. Arguably, this obstacle can be minimized by providing more information about the role of this topic for their future, such as showing videos about AAS that students suggested to increase their motivation. It is stated as follows.

> "… the video about an analyst using AAS was needed to present at the first moment (not only picture)." (high performance student)

Furthermore, if motivating students was successful, the obstacle 1 can be minimized.

The third obstacle is stated by the students through the result of the interview below.

> "…The condition of instrument laboratory was too crowded." (middle performance student)

This condition occurred because the instrument of AAS was limited. On the other hand, this obstacle can be still avoided by rearrangement the injection sample time in a better way.

Suggestions

To increase the implementation quality of authentic assessment with embedded cooperative learning guideline that can be optimizing the impact of the treatment on the students' performance, the obstacles should be further reconsidered. According to Gardner and Belland (2012), through several educational research, they suggested that in promoting students' active learning, like the authentic assessment with embedded cooperative learning guideline, it has to be supported by many efforts and puts many trials to get success in fulfilling students' needs in the learning activities.

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