



PROFILE OF SCIENCE TEACHERS' ASSESSMENT LITERACY

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ABSTRACT

Assessment literacy is fundamental for teacher because it is related to decision making task which will then give impact to students' future. Assessment literacy influences teachers' routine practice of assessment in classroom. Without knowing the current assessment literacy among teachers, it is difficult to monitor or give relevant reinforcement to improve the quality of assessment practice. Therefore, this study is aimed to figure out the profile of science teachers' assessment literacy through a 54-items questionnaire developed from Assessment Literacy Standard (ALS) from Michigan Assessment Consortium. The questionnaire consists of selected choice response and open-ended question. Fifteen secondary school science teachers voluntarily participated in this study which came from 9 school in West Sumatra. Then, data was analyzed with descriptive analysis technique. Our findings revealed that while most teachers agreed with the ideal condition of assessment practice stated in the questionnaire, most are not sure when it comes to analyzing data from assessment with statistic tools or taking the use of assessment result further to improve learning quality for both students and teacher themselves. Implication of these findings on the preparation program of science student teacher in Universitas Negeri Padang was discussed further.

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Keywords: science teacher, assessment literacy, science education, assessment for science learning

INTRODUCTION

Assessment literacy is an important aspect for teachers' professional knowledge (Huang & He, 2016; Hussain et al., 2019; Kahl et al., 2013; Khadijeh & Amir, 2015) which drive

the practice of assessment in daily teaching. Assessment literacy is made of individual's understanding on basic concepts and procedures of assessment which have high possibility to influence educational decisions (Popham, 2011).

Assessment literacy can be reflected from certain activities, such as: using high quality assessment matched with accurately defined learning targets, careful interpretation and highlight on potential extraneous factors, proper administration and scoring of assessment, and wisely communicating the result to parents, learners, and stakeholders (Engelsen & Smith, 2020; Gotch & French, 2014; Plake & Impara, 1996). Assessment literacy could be the bridge to connect the quality of assessment and students' achievement (Ashraf & Zolfaghari, 2018). Assessment literacy also could also motivate teachers to always improve their proficiency on assessment methods which will be beneficial for students learning (The National Task Force on Assessment Education for Teachers, 2016).

In practice, assessment literacy involve the ability to construct reliable assessment, effective administration and fair grading in order to facilitate valid instructional decision making (DeLuca et al., 2016; Khadijeh & Amir, 2015). Whether the assessment has a high- or low-stake situations, teachers must possess adequate literacy skills and be confident with their skills to perform assessment and communicating the result (Kruse et al., 2018).

Assessment literacy is commonly discussed among teachers, students, and other stakeholders in education, such as school leaders (Engelsen & Smith, 2020). The ultimate goals of this discussion are the improve of teachers' teaching and students' learning (Khadijeh & Amir, 2015).

In terms of construct, there are five element in assessment literacy, namely: literacy concept, measurement method, testing, scoring and grading, and statistic and reporting (Lim Hooi Lian & Wun Thiam Yew, 2016). However, as studies on literacy

keep developing, there are four themes in assessment literacy, namely: assessment purpose, assessment process, fairness, and measurement theory (Coombs et al., 2018; DeLuca et al., 2018). In addition to this four themes, communication of assessment result, assessment ethics, assessment for learning, and education and support for teachers are also taken into account (DeLuca et al., 2016).

Performing classroom assessment is one of teachers' main task (Mertler, 2003a) and it is should be done based on proper understanding and skills to perform assessment itself (H. A. Alkharusi, 2012; Plake & Impara, 1996; Popham, 2009). Study has found that teachers often do not prepare well prior to performing assessment on their class (Mertler, 2005). Measuring assessment literacy is very important because teacher always have to do this routinely, which potentially lead them to make erroneous interpretation, making incorrect decision its negative consequences, and make students suffer unintended (Stabler-Havener, 2018). As it is important to take assessment literacy into practice now, it become essential to understand contextual influences on teachers' learning and development (Pastore & Andrade, 2019).

Measurement of assessment literacy has been done with many instruments, such as Teacher Assessment Literacy Questionnaire ((TALQ) (H. Alkharusi, 2011b; H. A. Alkharusi, 2012; Beziat & Coleman, 2015), Classroom Assessment Literacy Inventory (CALI) (Hudaya, 2017; Mertler, 2005), Approaches to Classroom Assessment Inventory (ACAI) (Coombs et al., 2018), Assessment Literacy Inventory (ALI) (Hailaya et al., 2014; McGee & Colby, 2014; Mellati & Khademi, 2018). Among all instrument to measure assessment literacy, ALI seems to be the most widely used by far.

One of the reasons behind the importance of measuring assessment literacy is teachers' reflective teaching. The more literate a teacher is on assessment, the more reflective his/her would be on teaching (Ashraf & Zolfaghari, 2018). This reflection from time to time will eventually help teachers to improve their skills and thus be more literate on assessment (Levy-Vered & Nasser-Abu Alhija, 2015). The better assessment literacy teachers possess, the more confident they are in considering various methods to assess students' learning (Mertler, 2005). The utilization of variety of assessment method and strategies requires teachers' knowledge and skills of performing assessment (Hailaya et al., 2014; Khadijeh & Amir, 2015). Thus, the more literate a teacher is, the more likely they will contribute to students' academic achievements (Hussain et al., 2019).

Meanwhile, the scarcity of in-service trainings for teachers in different aspect of teaching in general and assessment in general has negatively affected the quality of teachers' teaching (Hussain et al., 2019; Kruse et al., 2018). Assessment literacy could be at risk if teachers are scared to assessment and testing, lack of sufficient training, and facing strong pressure from institution or stakeholders (Deneen & Brown, 2016).

In Indonesian context, in-service trainings are usually facilitated by the local and provincial government's educational affair office. However, in most occasions, the contents of training are decided upon the current need or situations rather than the actual need to improve teachers' professionalism. For example, due to pandemic of Covid-19, a lot of training on how to conduct hybrid or blended learning are held. However, there's is hardly a training on how to design assessment for such way of learning in pandemic.

Based on the introduction, the purpose of this study is to figure out the profile of

assessment literacy of science teachers in West Sumatra, and to reflect upon the profile to discuss further attempts should be done to improve the quality of science teacher preparation program in Universitas Negeri Padang. To achieve that purpose, research question is formulated as: to what extent does science teachers in West Sumatra possess assessment literacy?

METHOD

This descriptive study was conducted in August 2020 involving 15 secondary school science teachers from 9 schools in West Sumatra, mostly in Padang city. These teachers voluntarily fill out a questionnaire on assessment literacy which has been validated and proof-read by experts. The questionnaire was developed based on Assessment Literacy Standard (ALS) by Michigan Assessment Consortium (MAC) published in 2020 (Engelsen & Smith, 2020). The ALS for teacher consists of 54 items divided into three sections namely Disposition, Knowledge, and Performance. This questionnaire used 4 Likert-scale alternatives from Strongly Agree to Strongly Disagree. Data analysis was conducted through descriptive statistic technique in which we tried to map out teachers' profile on assessment literacy.

RESULT AND DISCUSSION

1. Profile of science teachers as subjects in this study.

Fifteen science teachers in 9 secondary schools in West Sumatra volunteered to participate in this study. Here's the profile of their academic background and experience in teaching.

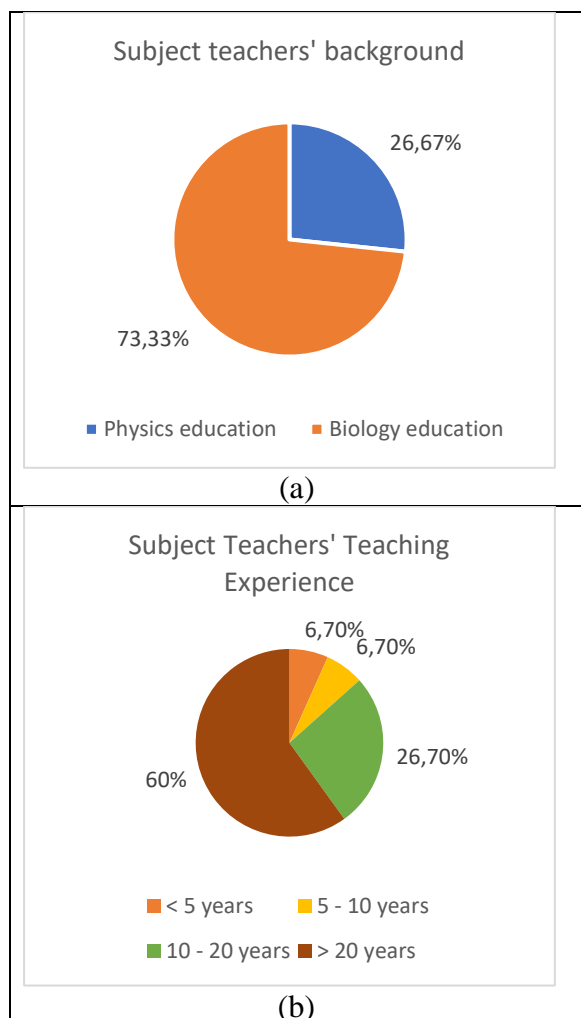


Figure 1. Profile of research subjects

All teachers participated in this study are female, most of them used to teach Biology before the subject was integrated with physics is secondary school. What is interesting is that more than half teachers are already above 40 years old with more than 20 years of teaching experience. Another interesting part is that young teachers are so a few in school, perhaps only one of none. So far, the profile of our subjects is all female, forty years old or more, mostly have expertise in biology with more than 5 years teaching experience. These findings indicate that majority teachers at schools are experienced teachers with more (more than 5

years) who have done countless assessment practice and decision making.

Teaching experience is often related to teaching skills. However, when it comes to assessment, teaching experience is found to have negative relation to teachers' assessment literacy (H. Alkharusi, 2011a). On the other hand, in-service training does have positive relation to assessment literacy (H. Alkharusi, 2011a). This finding is inline with the finding of in-service teachers who were not well-prepared in assessing their students' learning (Mertler, 2003b, 2009) probably due to lack of training in preparation program (Plake & Impara, 1996). Therefore, it is essential to keep conducting in-service training from time to time, rather than relying of such assumption about teacher's experience.

2. Disposition of Assessment Literacy

The first part of ALS inquires teachers about their believe of assessment literacy. Here is our finding. A study has found that learning of assessment is build upon four pedagogical constructs, namely: perspective-building conversation, praxis activities, modelling, and critical reflection and planning for learning (DeLuca et al., 2013). The more teachers engage themselves in a conversation about assessment, they are more likely to improve their understanding. Praxis is all about how teachers make connection between theory and practice by discussing the benefit of class structure, activities, and authentic learning tasks. Modelling means how teacher models what they do in assessment, such as analyzing data from classroom assessment. Critical reflection and planning indicate how teacher use this activity to use assessment as learning, to help promote better understanding on assessment itself.

Teachers' knowledge on assessment is argued as something could be changed over time; it's not fixed. In other words, it can be improved as long as teachers are willing to work on it. As long as teacher have the so-called growth mindset, what Carol Dweck describes as the act of seeking challenges, rebound from failures, and accept feedback or suggestion for improvement (DeLuca et al., 2019).

Table 1. Disposition of Assessment Literacy

Teachers who are assessment literate believe that	Teachers' response:	
	Strongly Agree	Agree
1. All science teachers should have sound understanding on assessment and its purposes.	66,70%	33,33%
2. An effective assessment system must balance the different purposes of assessment and the audience	46,70%	53,30%
3. An effective assessment system must use different methods and communications	53,30%	46,70%
4. When conducted properly, data from assessment can be used to make sound decisions.	80%	20%
5. Various methods of measurement provide more balance description about the students.	60%	40%
6. Assessment quality is a critical attribute on effective teaching and learning.	40%	60%
7. Result of assessment could be used to create decision to improve students' learning.	53,30%	46,70%
8. Clearly stated learning target and understood by the students is essentials for learning and assessment.	86,70%	13,30%
9. Effective feedback is highly important to support learning process.	66,70%	33,30%
10. Students are supposed to be effective learning partners for teacher in terms of assessment use to improve their learning.	60%	40%
11. Students can use sensitive assessment results to improve their learning. *) 3 teachers (20%) answered "not sure" to this item.	46,70%	33,30%

Teachers who are assessment literate believe that	Teachers' response:	
	Strongly Agree	Agree
12. Good assessment practice and good quality learning are two strongly interrelated things.	73,30%	26,70%
13. For teachers, grading is a professional judgement exercise, not only limited to numbers and mechanic analysis.	60%	40%

Basically, all subjects in this study agreed on all disposition or believe about assessment literacy. Even though there are 4 Likert-scale were provided as alternatives, teachers' responses fell between "Strongly Agree" and "Agree" only on this aspect. However, the degree of agreement is different on several items. Based on the gap in number of teachers for each item, we found these following patterns.

- a) A gap of more than 30% when it comes to items containing statement or beliefs that have already known in general about assessment, which are item 1, 4, 8, 9, and 12.
- b) A gap of more than 20% when it comes to items containing details about the use of assessment, which are items 5, 6, 10, and 13.
- c) A gap of less than 10% (1-person-difference) which indicate that all teachers basically have the somewhat equal responses between strongly agree and agree. These are the items the use of assessment by the students and the attribute of effective assessment system, which are items 2, 3, 7, and 11.

Unfortunately, we did not get the chance to inquire further to why some teachers chose strongly agree and not just agree. So far, we can conclude that all teachers agreed to the disposition of assessment literacy.

3. Knowledge of Assessment Literacy

Knowledge is the fundamental part in assessment literacy. This part is accountable for teachers' ability to design, implement, grade, and provide feedback in order to improve students' learning (Lam, 2019). A study found that teachers' classroom practice are driven by their understanding on the purpose of assessment (DeLuca et al., 2019). Simply put, Stiggins describe teachers who are literate on assessment will know what they assess, why they assess, possible problems with assessment, how to prevent them from occurring, aware of possible negative consequences of inaccurate assessment (Khadijeh & Amir, 2015). An assessment literate teacher will use their skill to develop high quality and accurate assessment which exactly demonstrate students' understanding and achievement (Mertler & Campbell, 2005).

The concept of assessment literacy itself could be expanded to describe the level of knowledge, skills, and understanding of principles and practice of assessment (Huang & He, 2016). In the questionnaire, teachers were asked about what should be performed in an effective system of assessment and other relevant aspect in measuring students' learning progress. Here is what we found from teachers' responses.

Following the previous tendency, teachers' response on this aspect also fall between "Strongly Agree" and "Agree" with an emerging pattern of gap for each item.

- a) For item 5 which asked about suitable assessment methods for selected-response, "Agree" response outnumbered "Strongly Agree" by 60% in gap. Similar tendency also appears for item 6 which asked the same question for students-generated response.
- b) Another item with 60% gap in agreement is item 3 which asked about teachers'

understanding about how to interpret assessment result based on criterion-referenced and norm-referenced.

- c) Other items which asked about general knowledge on assessment, there is only slight gap between "Agree" and "Strongly Agree" response.

Table 2. Teachers' Understanding about Assessment Literacy

Teachers who are assessment literate know that:	Teachers' response:	
	Strongly Agree	Agree
1. Good assessment system employs different methods for different purposes.	26,70%	73,3%
2. Good assessment system consider suitable methods for different purposes	46,70%	53,30%
3. How to interpret assessment result with criteria and norm reference.	20%	80%
4. Difference of characteristic instruments to assess achievement, aptitude, diagnostic, and screening.	46,7%	53,30%
5. For learning target "selected response" multiple choice, true-false, and matching questions could be used as assessment method.	20%	80,00%
6. For learning target "students'-generated response", open-ended or essay questions could be used as assessment method.	33%	67%
7. For learning target "performance", written test presentation, and product assessment are suitable to be used as assessment method.	53,30%	46,70%
8. For learning target "personal communication", observation and interview are suitable as assessment method.	60%	40%

For Knowledge section, degree of agreement also indicates teachers' confidence to state that the statements are correct. When teacher responded strongly agree, it means teachers are very confidence that the statement in correct and when they

responded “agree” it means they somewhat agree to the statement to some extent but still have some doubts about it.

Almost in all standard of assessment-related for teacher, understanding the purposes of and uses of each assessment is a must (H. A. Alkharusi, 2012). However, it is interesting to find that the subjects in this study have a slight difference of agreement (46,7% Strongly Agree and 53,30% Agree). The same tendency continues for the next item about characteristic of instruments for assessment. However, when it comes to selecting suitable type of questions for different learning target, teachers’ responses vary in degree of agreement.

There are four learning targets presented in the questionnaire, namely selected response (with multiple-choice, true-false, and matching); students’ generated response (open-ended questions); personal communication (observation and interviews); and performance (written test, presentation, and product assessment). The highest gap of agreement is when only one out fifteen teachers chose strongly agree to use multiple choice for selected response. Though in daily practice, our interview revealed that multiple-choice items are the most frequently and widely used in all kinds of assessment performed in school. Interestingly, a study has found that the ability to design and select appropriate assessment tools and the use of assessment tools during teaching learning process do not have significant relationship to students’ academic achievement (Hussain et al., 2019).

There are several indicators in Knowledge section where teachers’ responses fell into three alternatives out of four provided. These indicators are related to statistical analysis of the assessment result. Table 3 provide more detail on this finding.

Table 3. Teachers’ Understanding about Statistical Analysis of Assessment Result

Teachers who are assessment literate know that:	Teachers’ response:		
	Strongly Agree	Agree	Not Sure
9. How to measure statistic concepts related to assessment data such as mode, mean, and median.	13,30%	80%	6,70%
10. What reliability means in assessment context and how to determine the reliability.	20%	60%	20%
11. What variability means related to assessment data and how to calculate it.	20%	60%	20%
12. Validity indicate the characteristic of assessment use, not the assessment itself.	13,30%	80%	6,70%
13. What does bias and sensitivity related to assessment.	6,70%	73,30%	20%
14. What correlation and causality mean in assessment context	20,00%	60,00%	20,00%
15. There are two ways to interpret assessment result: criterion and norm-referenced.	40%	60%	0%
16. Different assessment data sources could reflect valid effectivity of teachers’ teaching.	13,30%	73,30%	13,30%

**) Item’s numbering is continued from previous table*

When it comes to statistical analysis, generally 1- 3 teachers out of 15 stated not sure about the given statements. Items with the highest percentage of teacher answering “not sure” are items 10, 11, and 15 which are related to variability, reliability, correlation, and causality, fundamental concepts in statistical analysis in educational assessment. To be skillful in interpreting results of students assessment is one of the standards teacher should fulfill (H. A. Alkharusi, 2012). Interpretation of assessment result requires statistical analysis. Thus, this finding

should be taken care since decision making should be done based on statistical analysis to make in contains less bias.

Table 4. Teachers' understanding on several procedures in performing assessment

Teachers who are assessment literate know that:	Teachers' response:	
	Strongly Agree	Agree
17. How to define learning purpose from basic competency then written in easily-understood sentences for the students.	57,10%	42,90%
18. How to deliver positive feedback based on assessment result for different audience, either for descriptive or evaluative purposes.	57,10%	42,90%
19. How to use different measurement tools (guidance, rubric, answer key, checklist, standard, and so forth).	33,30%	66,70%
20. How to score correctly and report the result.	46,70%	53,30%
21. How to engage students to use their assessment result to reflect upon their own learning and to formulate learning purposes. *) One teacher (6,7%) responded "not sure" to this item.	46,70%	46,70%

*) Item's numbering is continued from previous table

In the questionnaire, an open-ended question asked teacher to choose what activity they have to do in order to construct a high-quality assessment. This item is related to the themes of assessment process in literacy, which include: developing, administering, collecting information, scoring, interpretation, making decision, developing valid grading procedures, and monitoring and revising assessment process (DeLuca et al., 2016). Teachers' response can be seen in Table 5.

These eight activities were put in presumably chronological steps in designing an assessment. However, when teachers are asked what activity they should do in constructing high-quality assessment, the responses do not go along with the presumed order.

Table 5. Activity in Constructing High-quality Assessment

Activity	Number of teachers agreed (%)
1)Determine the purpose of assessment	66,70%
2)Determine the standard or learning targets to be assessed	66,70%
3)Decide upon assessment method suitable with purpose of learning and assessment	86,70%
4)Design test which enable conclusion making related to students' achievement.	66,70%
5)Choose or Construct necessary assessment items and scoring tools when needed.	93,30%
6)Conduct field trial on assessment or review prior to reporting the result.	73,30%
7)Improve the quality of assessment through review or analysis to eliminate bias and deviation.	60,00%
8)Purchase license or develop instrument for assessment, each with advantage and disadvantage.	26,70%

The highest percentage goes to "choose or construct necessary assessment items and scoring tools when needed" and the second highest is "decide on assessment method suitable with the purpose of learning and assessment". These two are the indispensable steps in designing assessment, so they should be done at all cost. Other than these two, more than half teachers agreed to the listed activity, except for one that is purchasing license or developing instrument for assessment. It seems like teachers in this study did not agreed to think that a licensed instrument is necessary.

Another open-ended question given to teachers is about the use of students' assessment (Figure 2). There are three purposes of assessment, that is assessment of learning (AoL), assessment for learning

(AfL), and assessment as learning (AaL) (Coombs et al., 2018).

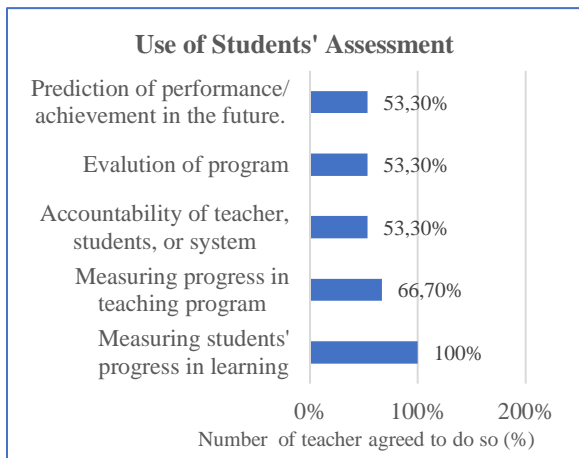


Figure 2. Teachers' understanding on the use of students' assessment

Figure 2 reveals that all teachers in study agreed that students' assessment can be used to measure students progress in learning. As for other uses, only half teachers agreed that students' assessment can be used to measure progress in teaching program (in other word: as teachers' reflection), as a measurement of accountability for teachers, students, and program, as an evaluation of program, and as a tool to predict students' future performance. These responses could indicate that teachers in this study still not fully aware of the use of students' assessment despite the long experience they have in teaching. This finding is in accordance with the study conducted in Hongkong (Lam, 2019).

Enhancing teachers' knowledge on assessment could be done through several ways, such as coursework, professional development program, in-service training or self-study via textbooks (Lam, 2019). However, in Indonesian context, there are other consideration in offering these enhancement program to teachers such as academic calendar, school events, teachers' assignment deadlines, and so forth.

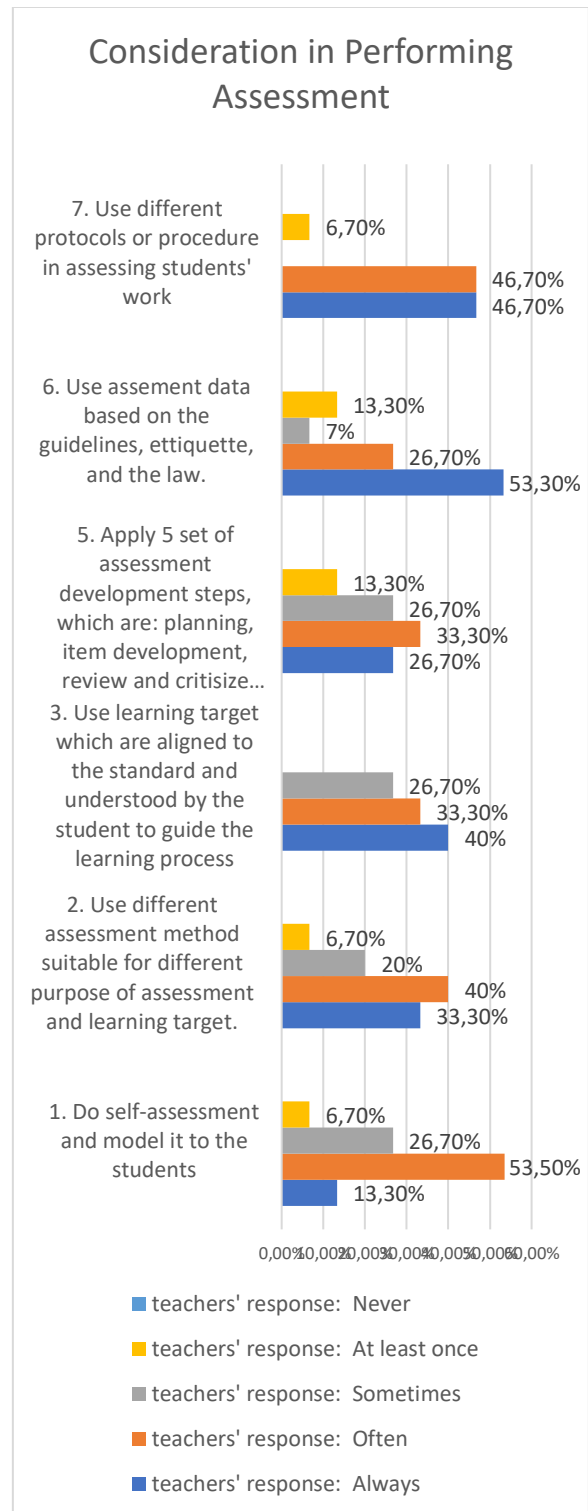


Figure 3. Teachers' Consideration in Performing Assessment

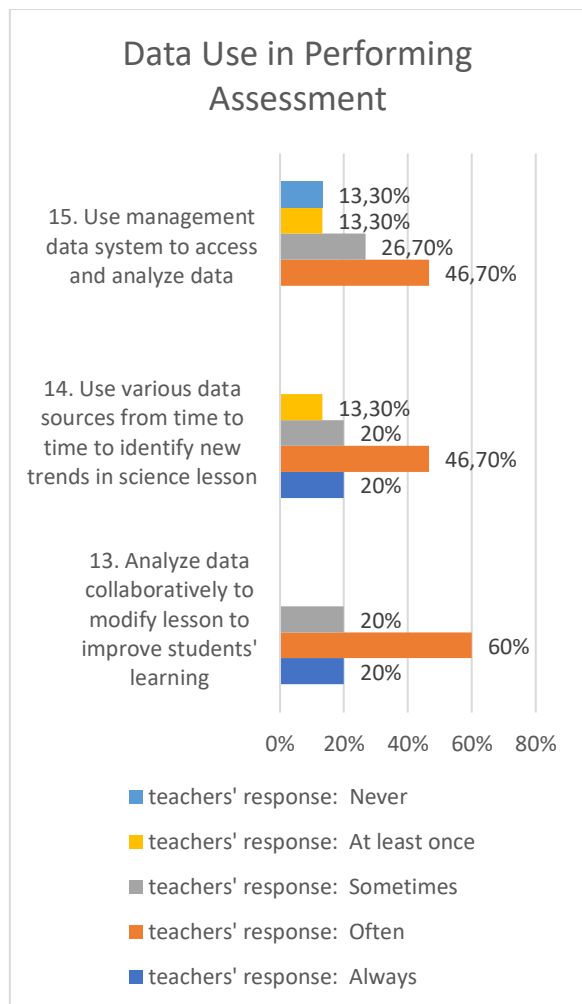


Figure 4. Teachers' Use of Data in Performing Assessment

4. Performance of Assessment Literacy

Performance of assessment is viewed as how teacher use their knowledge of assessment and belief system to guide their practice of assessment (Lam, 2019). To help make it easy to discuss, teachers' performance on assessment literacy is divided into three sections which focuses on: consideration in performing assessment, data use in performing assessment, and use of assessment result.

Teachers' use of data in performing assessment (Figure 4) is related to the themes of assessment ethics and measurement theory in assessment literacy. Assessment ethics

include the practice of disclosing accurate and balanced information, which is why teachers have to use various data sources from time to time; minimizing bias by using data system and collaboratively analyzing data; and complying with the standard used in the institution (DeLuca et al., 2016). On the other side, measurement theory is related to the reliability, validity, and the use or norms and standard in grading (DeLuca et al., 2016).

A well-designed feedback is a crucial factor students' learning, as without it students will be more likely to continuously making the same mistake (Darling-Hammond et al., 2020).

Communication of assessment result include the activity of delivering the purpose and process of assessment, articulating grading procedures, and then communicating result to parents and stakeholders (DeLuca et al., 2016).

As what has been found in this study and, we would like to emphasize the urgent need to conduct in-service trainings for teachers at all level of experience. Furthermore, since it has been found that a course focusing specifically on assessment of student learning contributes to the assessment literacy of teacher candidates (McGee & Colby, 2014; Ogan-Bekiroglu & Suzuk, 2014), it is recommended to optimize preservice teachers' learning through any relevant course in the university. 'What is needed to improve assessment literacy is more than a brief mention of assessment in a course', it takes appropriate text, and meaningful understanding (Popham, 2011).

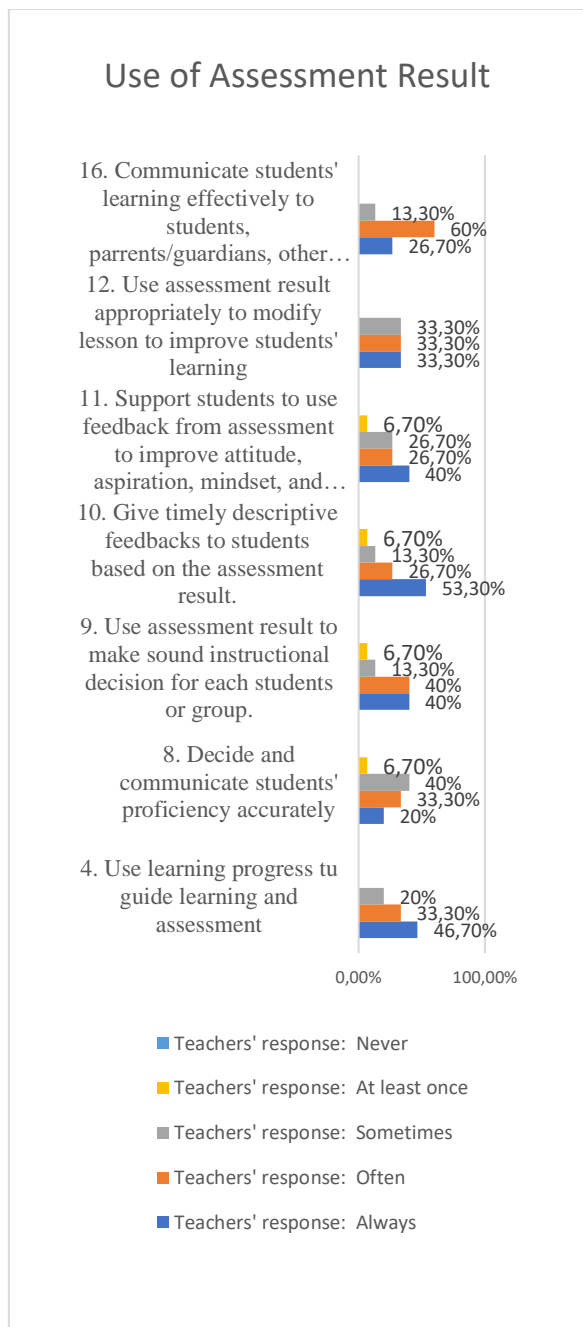


Figure 5. Teachers' Understanding of The Use of Assessment Result

CONCLUSION

Regarding the disposition about assessment literacy, all teachers in this study agreed to the statement slight variation in degree of agreement. The same tendency also found for knowledge section, however for items related

to statistical analysis on assessment result, generally 1-3 teachers responded “not sure” on the given statement. For performance section, generally teacher responded in three categories: Always, Often, and Sometimes.

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