

Development of Biological Teacher Capabilities in The Development of Test Instruments Based on High Order Thinking Skills (HOTS) In High School in Ambon City That Have Applied 2013 Curriculum

Fredy Leiwakabessy¹, Monika Hetharia¹, and R. A. Manuputty²

¹ Lecturer of Biology Education Department, Faculty of Teacher Training and Education, Pattimura University, Ambon-Indonesia.

² Staff of the Lecturer of Biology Education Department, Faculty of Teacher Training and Education, Pattimura University, Ambon-Indonesia

E-mail: fredyleiwakabessy@yahoo.com

Abstract. Research has been conducted to find out, 1) the ability of biology teachers in compiling test instruments, correcting student test results, analyzing student test results and reporting tests on HOTS-based students; 2) difficulties faced by biology teachers in doing these four things; and 3) alternative solutions that can be taken to overcome these difficulties. The study was conducted from July to August 2018, specifically for biology teachers in high schools in Ambon who have implemented the 2013 curriculum with 16 teachers. Data were obtained through questionnaires, interviews, and collection of questions. The questions analyzed were biology / odd semester / semester of 2017/2018 academic year on the 2013 curriculum. The results of this research are: 1. Biology teachers in compiling test instruments (93.75%), correcting the student test results (68.75%), analyzing student test results (68.75%), and report. student test results (43.75%), 2) difficulty in compiling test instruments (87.5%), difficulty correcting test results (31.25%), difficulty analyzing test results (37.5%), and difficulty reporting student test results (12.5%), 3) alternative or solution that will be done in the Higher Order Thinking Skill based test instruments.

Keywords: *Teacher Ability, HOTS (Higher Order Thinking Skills), Test Instruments*

1. Introduction

One very important and inseparable aspect of learning activities is learning evaluation. According to Widoyoko, that evaluation activities include the steps to measure and assess. Measuring activities are carried out by comparing something measured by one particular measure, the results of measurements in the form of quantitative data while the activity of assessing is a process of taking a decision on

something that is judged good and bad, the results of the assessment are qualitative data [1].

Regarding *assessment*, *The Task Group on Assessment and Testing* (TGAT) describes assessment as all the methods used to assess individual or group performance [2]. Another view of learning outcomes assessment is put forward by Ussher & Earl that assessment also refers to examining the achievement of learning programs at the end of the process and also helps teachers to make decisions [3].

According to Donovan, 21st Century Education is also known as the *knowledge age*, in this era, all alternative efforts to fulfill the needs of life in various contexts are more knowledge-based. Addressing the needs of the education sector-based knowledge (*knowledge based education*), economic development based on knowledge (*knowledge based economic*), community development and empowerment-based knowledge (*knowledge based social empowerment*), and development in the business sector-based knowledge (*knowledge based industry*). Formal education to date still tends to train students to memorize facts, so most students are hampered and helpless in facing problems that demand creative thinking and problem solving. The ability of students to be less able to connect the concepts / subject matter they learned with how much of the knowledge was used is still found in the teaching-learning process in schools [4].

At present, education is in the *knowledge age* by accelerating the increase in extraordinary knowledge. This accelerated increase in knowledge is supported by the application of digital media and technology called super highway information [2]. Style learning activities at the time of knowledge (*knowledge age*) should be tailored to the needs at the time of knowledge (*knowledge age*) sehingga, learning must provide a more authentic designs for through the challenges which the participants can collaborate to create a solution to solve the problem lesson. Problem solving leads to questions and looks for answers by students who can then find problem solving in the context of learning using available information resources.

Higher Order of Thinking Skill (HOTS) is the ability to think critically, logically, reflective, metacognitive, and creative thinking which is a high-level thinking ability that can support and solve problems faced in education today. Heong et.al states that HOTS is one component of the ability to think creatively and think critically [5]. 2013 curriculum also requires learning material to metacognitive which requires students to be able to predict, design, and estimate. In line with that the realm of HOTS namely the analysis of which is the ability to think in specifying aspects or the elements of a particular context. Evaluation is the ability to think in making decisions based on facts, information and creating the ability to think in building ideas / ideas. These abilities are upper level thinking skills in Bloom's later taxonomy revised by Anderson and Krathwohl, with the following classifications

To test students' thinking skills, questions to assess learning outcomes are designed in such a way that students answer questions through thinking processes that

are in line with operational verbs in Bloom's taxonomy, both in terms of knowledge, attitudes and skills. In learning it is stated that the ability of students is not only to master a set of knowledge in the form of facts, concepts, or principles but also a process of discovery, meaning students must always be invited to learn by using thought processes to find concepts - the concept.

2. Methods

2.1 Research Type

This type of research is descriptive research, with qualitative and quantitative approaches.

2.2 Place and time of research

This research was conducted in high schools in Ambon City which had implemented the 2013 curriculum both in public schools and private schools. In this study the State High Schools that have implemented the 2013 curriculum are Ambon 1 Public High School, Ambon 3 Public High School and Ambon Siwalima High School. While the Private High School is Ambon Xaverius High School.

2.3 Research variable

The variables examined in this study include: (a) the ability of high school Biology teachers to develop HOTS-based test instruments; (b) the ability of high school biology teachers to correct HOTS-based student test results; (c) the ability of high school biology teachers to analyze HOTS-based student test results; (d) the ability of high school Biology teachers to compile HOTS-based student test report results; (e) obstacles or difficulties experienced by Biology teachers in developing test instruments, correcting test results, analyzing test results and compiling reports on HOTS-based assessment results; and (f) alternative solutions that can be made by stakeholders to overcome the obstacles or difficulties experienced by high school Biology teachers in developing test instruments, correcting test results, analyzing test results and compiling HOTS-based assessment reports.

2.4 Research Population and Samples

The population in this study were all teachers in high schools who had implemented the 2013 curriculum. While the samples in this study were teachers who taught national exam subjects, namely, Biology subject teachers.

The research *sampling technique* was *purposive sampling*, where the sample was determined by researchers focused on teachers who taught national exam subjects to the four target schools.

2.5 Research Instrument

In the research compiled several instruments in the form of questionnaires, interview guidelines, review sheets for evaluation documents of each teacher, ranging from assessment planning, implementation of assessment, processing of assessment results, to utilization and follow-up assessment results. In addition, documentation of the

device is also collected as fact data for further analysis, as well as photo documentation using a digital camera.

Questionnaires are arranged using a Likert scale, which will be used to identify the steps taken by the teacher in developing evaluation tools.

2.6 Data analysis technique

The likert scale processing step to identify the development of written test assessment instruments can be calculated using the *Microsoft Excels 2010 program* as follows :

- a. Determine the number of respondents' score based on the Always choice
- b. (SL), Often (SR), Sometimes (KK), Never (TP).
- c. Determine the ideal score.
- d. Determine the percentage score of the respondent's answer
- e. Determining the average scale then the results are confirmed by criteria: Very Good (SB), Good (B), Enough (C), Less (K).

a. Data analysis techniques using percentage statistics.

Assessment sheet reviews assessment development tools; from the score the results of the assessment of the appraisal development tools are obtained using the formula:

$$value = \left(\frac{score\ obtained}{maximum\ score} \right) \times 100$$

Interview Guidelines, to find out the ability of National Examination subject teachers in developing assessments and the obstacles experienced by teachers in developing assessments obtained by using the formula:

$$value = \left(\frac{score\ obtained}{maximum\ score} \right) \times 100$$

Kunandar, said the interview results were described according to the categories according to table 1 [6].

Table 1. Category h g uru acyl Interview National Examination subjects in the development of assessment

Value	Category
91 - 100	Very good
81 - 90	Well
71 - 80	Enough
60 - 70	Not good
< 60	Very Poor

3. Results and Discussion

3.1 Review of HOTS Questions in the Form of Multiple Choice.

From the results examined, all the questions from the school that are the place of research meet all aspects of the material studied, but at the cognitive level all questions from different schools have different levels of knowledge. From this different level the level obtained from C1 to C6. Anderson and Krathwol (2017) argue that the characteristics of the questions developed refer to the ability to use certain factual, conceptual, and procedural knowledge on concepts, and problem solving so that the teacher's ability to develop test instruments must measure ability students with HOTS category in each material that has been given to students, so students are able to analyze, evaluate, and create.

Table 2. Presentation of Cognitive Level Levels in Semester Test Questions

No	School	Classes	Number of questions	Cognitive Levels						Presentation
				C1	C2	C3	C4	C5	C6	
1.	Ambon 1 Public High School	X	50	10%	14%	30%	28%	12%	6%	100%
		XI	20	25%	30%	30%	10%	5%	0%	100%
		XII	40	0%	25%	12.5%	47.5%	15%	0%	100%
2.	Ambon State High School 3	X	10	0%	60%	30%	10%	0%	0%	100%
		XI	16	0%	6.25%	81.25%	12.5%	0%	0%	100%
		XII	16	6.25%	12.5%	37.5%	37.5%	6.25%	0%	100%
3.	Ambon State High School 4	X	40	10%	22.5%	20%	37.5%	10%	0%	100%
		XI	30	0%	10%	30%	23.3%	20%	16.6%	100%
		XII	40	0%	0%	37.5%	35%	20%	7.5%	100%
4.	Siwalima State High School Ambon	X	10	100%	0%	0%	0%	0%	0%	100%
		XI	10	100%	0%	0%	0%	0%	0%	100%
		XII	35	0%	2.85%	25.7%	68.5%	2.85%	0%	100%
5.	Xaverius High School Ambon	X	35	0%	68.5%	28.5%	2.85%	0%	0%	100%
		XI	35	0%	14.2%	17.1%	31.4%	34.2%	2.85%	100%
		XII	35	0%	11.4%	17.1%	22.8%	28.5%	17.1%	100%

3.2 The questionnaire assessment research presentation is the teacher's ability to develop HOTS-based semester final test instruments.

From the results of the study through questionnaires given to each high school teacher in Ambon City, different presentation scores were obtained. Judging from the total number of teachers is 15 people.

Table 3. Presentation of the Total Overall Assessment of Questionnaire on the Ability of Biological Teachers in Developing Test Instruments Based on HOTS (Higher Order Thinking Skill)

A. Development

No.	Assessment Aspects of Questionnaires				Frequency	Presentation
	Arrange	Correcting	Analyze	Report		
1.	15 100%	11 0.73%	11 0.73%	7 0.46%	44	6.6%

B. Difficulties

No.	Assessment Aspects of Questionnaires				Frequency	Presentation
	Arrange	Correcting	Analyze	Report		
1.	14 2.1%	5 0.75%	6 0.9%	2 0.3%	27	4.05%

Assessment presentations in terms of the ability to compile test instruments, it can be seen that 15 teachers or 100% are able to compile a test instrument; the ability to correct is seen that there are 11 teachers or 73% always correct the test results; the ability to analyze shows that there were 11 teachers or 73% who were able to analyze the results of the test, and the ability to report the test results, only 7 teachers or 46% were always reporting the results of the tests. Then the number of teachers from each high school in Ambon City for difficulties in compiling HOTS-based test questions shows that 14 teachers or 2.1% were unable to arrange test questions; difficulty correcting seen 5 teachers or 75% teachers difficult to correct test results; difficulty in analyzing it can be seen that 6 teachers or 9% of teachers were unable or did not know the steps needed to analyze test questions; and the difficulty of reporting the test results shows only 2 teachers or 3% were only able to make a test report. The following is a table of values for the presentation of teacher abilities.

3.3 Level of difficulty and differentiation

For analyze the questions developed by the teacher about quality question, then used analysis level difficulty and power differentiator. From the research conducted, it was obtained results as the following in the following table.

Table 4. Level of Difficulty and Distinguishing Power

Ambon 1 Public High School

Class	Number of questions	Form of Problem	Difficulty level		Power Difference	
			No Problem	Qualification	No Problem	Qualification
X	50	PG	18,37, 30,47,38,41,42, 43,44, 39,50,40	Easy	9,27,10,28,29,1 2,30,13,31,32,3 3,34,35,36,41,4 2,43,44,45,47	Very well
	Presentation		(24%)		(40%)	
			1,2,9,10,11,12,1 3,19,27,28,29,3 0	Is being	1,2,3,4,5,6,7,8,1 1,12,19,20,21,2 2,23,24,25, 26,46,48,49,50	Well
	Presentation		(24%)		(44%)	
			3,4,5,6,7,8,9,13, 14,15,16,17,21, 22,23,24,25,26, 31,32,33,34,35, 36	Hard	14,15,16,17,18, 37,38,38,40	Enough
Presentation		(48%)	(18%)			

Ambon State High School 4

Class	Number of questions	Form of Problem	Difficulty level		Power Difference	
			No Problem	Qualification	No Problem	Qualification
X	30	PG	7,21,22,23,24,25	Easy	5,7,21,22,23,24,25,26, 27,28,29,30	Ugly
					20%	
			2,3	Hard	1,5,7,14,17,18,19,20,2 1,22,23,24,25,26,27,28 ,29,30	Well
					6.66%	
			1,4,6,8,9,10,11,12, 13,14,15,16,17,18, 19,20,26,27,28,29, 30	Is being	2,3,4,6,8,9,10,11,12,13 ,15,16	Enough
	70%	40%				
Class			Difficulty level		Power Difference	

	Number of questions	Form of Problem	No Problem	Qualification	No Problem	Qualification
XI	30	PG	1,2,5,6,7,8,9,10,11,12,16,18,20,23,24,25,27,28,29,30	Easy	-	Ugly
			66.6%		0%	
			3,4,7,13,14,15,17,19,21,22,26	Is being	1,2,4,5,6,7,9,10,11,12,13,14,15,16,17,20,23,24,25,29	Well
36.6%	66.6%	Enough				
					3,8,18,19,21,22,26,27,28,30	33.3%
Class	Number of questions	Form of Problem	Difficulty level No Problem	Qualification	Power Difference No Problem	Qualification
XII	40	PG	1,2,3,4,6,7,8,12,13,14,16,17,19,20,21,22,28,29,30,31,32,33,34	Easy	7.12	Well
			57.5%		5%	
			5,9,10,11,15,18,23,24,25,26,27,35,36,37,38,39,40	Is being	1,2,3,4,5,6,8,9,10,11,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40	Enough
42.5%	95%					

Xaverius High School Ambon

Class	Number of questions	Form of Problem	Difficulty level	Qualification	Power Difference	Qualification
			No Problem		No Problem	
X	35	PG	2,4,5,6,10,11,18,22,23,25,32,33,	Easy	1,2,3,4,5,6,7,9,10,11,16,18,20,22,23,24,25,27,28,29,32,33	Very good
			34.2%		62.8%	
			12,13,17,19,21,30,35	Hard	8,13,14,15,26,31,34	Well
			20%		20%	
		1,3,7,8,9,14,15,16,18,22,23,24,25,32,33,	Is being	17,30,35	Enough	
				12,19,	Less	
Presentation			42.8%		5.71%	

Class	Number of questions	Form of Problem	Difficulty level		Power Difference	
			No Problem	Qualification	No Problem	Qualification
XI	35	PG	4,5,9,10,13,15,18,22,24,34	Easy	1,3,5,8,9,10,12,13,15,16,18,19,20,22,24,26,28,30,31,33,34	Very good
			25.7%		60%	
			6,7,14,17,23,25,27	Hard	2,11,14,21,23,25,27,29,32,35	Well
			20%		28.5%	
1,2,3,8,11,12,16,19,20,21,26,28,29,30,31,32,33,35	Is being	6.17	Enough			
5.71%		7		Less		
Presentation			51.4%			
Class	Number of questions	Form of Problem	Difficulty level		Power Difference	
			No Problem	Qualification	No Problem	Qualification
XII	40	PG	1,7,9,14,15,19,26,31	Easy	7,9,14,15,26,28,31	Very good
			20%		17.5%	
			3,4,5,8,10,11,12,13,17,18,21,22,23,27,29,30,32,33,34,35	Hard	8,19,33	Well
			50%		7.5%	
2,6,16,20,22,23,27,29,30,32,33,34,35	Is being	1,2,6,16,20,21,22,24,25	Enough			
		22.5%		3,4,5,10,12,13,17,18,23,27,29,30,32,34,35	Less	
Presentation			32.5%			37.5%

d. validity and reliability

Form of Problem	School name	Number of Issues	Reliability		Validity			Percentage (%)
			No. Question	Qualification	Qualification			
					Valid	Percentage (%)	Invalid	
PG	Ambon 1 Public High School	50	1-50	Very high	1,2,4,5,8,9,10,12,15,17,18,19,20,21,24,25,26,27,28,29,30,32,33,34,35,36,37,38,39,40,41,42	64%	3,6,7,11,12,14,15,17,23,24,43,44,45,46,47,48,49,50	0.26%
PG	Ambon State High School 4	30	1-30	Very high	5,11,12,19,21,29	20%	1,2,3,4,6,7,8,9,10,13,14,15,16,17,18,19,20,22,23,24,25	86.6%

							26,27,28,30,	
PG	Xaverius High School Ambon	35	1-35	Very high	1,3,4,5,6,7,8,12,13,14,15,16,17,18,19,20,21,22,25,29,30,34	62.85%	2,9,10,11,23,24,26,27,28,31,32,33,35	37.14%

Very high reliability results were obtained in Ambon 1 Public High School, Ambon 4 Public High School, Siwalima Ambon High School, and Ambon Xaverius High School. While the low level of reliability was found in Ambon State High School 3. This result is calculated using *SPSS 16 for windows*. The results that have been analyzed are each item produces the results of reliability for each school. Ha sil low supported by teachers' ability assessment questionnaire that states that do not yet understand how to analyze the matter is good and right. High and low reliable because it is not from the work of students but rather the questions developed by subject teachers as a measure of the ability of students / students. The results obtained are reinforced by the opinion of an expert that if the measuring object is the same, the results of measuring through items that are one contradiction or inconsistent with the results of measurements through other items then the measurement with a test (measuring instrument) as a unit cannot be used for reveal the true characteristics or conditions of a measuring object. If the measurement results on the same part of the measuring object between items one with the other items contradict each other or are inconsistent then we do not blame the measuring object, but a measuring instrument (test) that is blamed by saying that the test is not reliable against the object being measured [7].

Question validity was measured from each item analyzed. The school, which has about valid or feasible to use very high at SMA Negeri 1 Ambon, SMAN 4 Ambon and Ambon Xavier High School with the results presentasi (0.64)% with the amount of about 37 questions valid from class X. While schools that do not have a valid question at all or few at Ambon State High School 3 with presentation results (0.2)%. This shows that the questions at Ambon 1 Public High School, Ambon 4 Public High School, Siwalima Ambon High School, and Ambon Xaverius High School are feasible to use while the invalid ones are discarded or revised again. Then in Public High School 3 Ambon is a lot of questions that are invalid because the analysis of the questions has not been understood by subject teachers with manual calculations through calculation formulas, steps for preparing good questions, and guiding questions analysis.

4. Conclusion

Based on the results of research that has been analyzed and discussed descriptively qualitatively and quantitatively, it can be concluded that:

1. The ability of biology teachers in class X, XI, and XII in developing test instruments at the end of the semester semester 2017/2018 academic year is based on HOTS, judging from the review of HOTS questions, assessment questionnaires, level of difficulty, differentiation, validity, and reliability of the questions obtained very good results and less in each school.
2. The teacher's ability obtained in compiling HOTS questions leads more to the factual, conceptual, and procedural dimensions of knowledge. For the dimension of knowledge metacognition is not widely used in the questions arranged. The questions compiled are seen based on the ability of class X students. So the cognitive level levels that tend to be used for each school are more directed at C4 (analysis) and C5 (assessment) (levels I and II).

5. Reference

- [1] Widoyoko, S, E, P. (2009). *Evaluasi Program Pembelajaran, Panduan Praktis Bagi Pendidik dan Calon Pendidik* . Pustaka Pelajar. Yogyakarta
- [2] Griffin, P., & Nix, P. (1991). *Educational Assessment and Reporting* . Sydney: Harcourt Brace Javanovich, Publisher.
- [3] Earl, K. & Giles, D. (2011). An-other Look at Assessment: Assessment in Learning. *New Zealand Journal of Teachers' Work, Volume 8, Issue 1, 11-20*.
- [4] Donovan, MS, & Bransford, JD (Eds.). (2005). *How students learn: History, mathematics and science in the classroom* . Washington: National Academies Press.
- [5] Heong, YM, Widad BMY, Tee T. K, Razali B. H, and Mimi MBM (2011). *The Level of Marzano Higher Order Thinnking Skills among Technical Education Students. International Journal of Social Science and Humanity* .
- [6] Kunandar, (2014). *Authentic Assessment, Assessment of Learning Outcomes of Students Based on 2013 Curriculum 3* , Rajawali Press: Jakarta.
- [7]Suryabrata, S. (2000). *Pengembangan Alat ddan Ukur Psikologi*. Yogyakarta : Andi.