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HOTS-authentic Assessment Model Implementation of Tissue Structure Materials in High School of Malang: A pre-validation Final Draft

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Abstract

Higher-Order Thinking Skills (HOTS) must be owned by students, and need to be assessed authentically. This study aimed to 1) analyze the efforts of high school teachers in Malang in developing a HOTS-authentic assessment in tissue structure materials; and 2) analyze the pre-validation final draft of the HOTS-authentic assessment model on tissue structure materials. The research method used was Research and Development (R&D). However, in line with the objectives, this publication only focuses on define, design, and develop. The developed part is only on the product (a pre-validation final draft). The research was carried out in state high schools in Malang (SSHS 1, 3, 4, 7, and 8). The study was conducted in April-November 2018. The subjects were 2 teachers from each school (10 teachers in total). Research data and findings were analyzed by descriptive-analytic qualitative. The results showed that teachers have included or considered HOTS aspects in lesson plans. However, the development of HOTS aspects and their assessment were not able to be carried out maximally. In practice, in a greater percentage, teachers use lesson plans without modification or making adjustments to student conditions. They modify and incorporate the HOTS aspect if there is an opportunity to discuss with other part who guide them. Therefore, the existence of this assessment model is very needed. The pre-validation final draft is essentially in the form of concepts that can be linked to the MGMP activities, and various related part, in an interactive and cyclical relationship (as a model for professional development of biology teachers).

Keywords: HOTS; Authentic assessment; Tissue structure materials

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INTRODUCTION

Biology learning is carried out in high school is learning that can provide knowledge and skills to continue to tertiary education. In learning biology, students are required to be skilled in higher-order thinking skills (HOTS), be independent, and be responsible (Dinni, 2018; Lom, 2012; Mcmahon, 2007). Current reality shows that HOTS which is owned by students and university graduates is still very low (Corebima, 2016; Ramdiah et al., 2018), because learning that develops HOTS has not been handled well (Rofi'uddin, 2000). Therefore, the development of HOTS consistently and holistically is very important to be integrated in every subject (Maftukhah & Roshayanti, 2016). Various analyzes show that the tendency of students in Indonesia to have a weak impetus when discussing, solving critical-creative type problems, and when given problem-solving assignments (Sunaryo, 2013; Triani et al., 2018).

The implementation of biology learning must be designed to encourage students to carry out deep explorations, the activities of which they design themselves (Ngabekti, 2006). Biology learning needs to be conditioned in an atmosphere that encourages students to use

HOTS in addressing various problems or material being studied. Understanding a problem is shown by knowing what is known and asked, while planning is a problem solving in the form of organizing existing information creatively by using certain strategies to find possible solutions. Students able to plan problem solving requires adequate HOTS (Aryani, 2017; Priadi et al., 2012).

HOTS is a thinking ability that not only requires the ability to remember, but requires other higher abilities, such as the ability to think creatively and critically. Seeing the expected thinking skills in learning, the assessment system must be done thoroughly. The ability to think is a process of skills that can be trained. Therefore, there is a need for a good assessment instrument and in accordance with these needs. A good test instrument can improve the quality of assessment results, especially in the form of a student's ability profile (Lindawati et al., 2016; Rofiah et al., 2013). The implementation of HOTS in the context of the assessment simply does not only minimize the ability to recall information (recall), but rather measures the ability to: 1) transfer one concept to another, 2) process and apply information, 3) look for links of different kinds of information, 4) using information to solve problems, and 5) critically examining ideas and information.

Accordingly, specifically in class XI, there are 14 basic competencies (*Kompetensi Dasar* or KD) that are charged, and 10 basic competencies including KD (KD 3.3 to 3.10 for knowledge competencies and KD 4.4 to 4.10 for skills competencies) are related to "Plant and Animal Tissue Structure" (Permendikbud, 2016). Thus, it can be said that the Tissue Structure Materials has a contribution in determining the development of HOTS aspects of students. Specifically, in several high schools in Malang, based on observations and interviews with biology subject teachers, it shows that teachers have difficulty in teaching Tissue Structure Materials. The teacher really needs the development of learning that accommodates HOTS ability development. Teachers have sought to apply Student Centered Learning (SCL) learning innovations with methods of cooperative learning, discovery learning, problem-based learning, and inquiry learning. However, teachers have not yet developed a HOTS-based authentic assessment model. So far, there is only the task of making papers, middle-test questions, and final-test questions. The material used is also just a learning package book and worksheets.

Improving the quality of education can be characterized by the way students think in carrying out the learning process and is determined through an authentic assessment of student learning outcomes (Al Kadri et al., 2011; Darling-Hammond et al., 2019; Pantiwati & Husamah, 2017). Authentic assessment is an evaluation process that involves various forms of measurement of performance that reflect student learning, achievement, motivation, and attitudes to activities that are relevant in learning (Rukmini & Saputri, 2017; Suarimbawa et al., 2017). Authentic assessment is an assessment of student development, because this assessment focuses on their abilities and development in learning, so that this assessment is able to describe what was measured before and after they learned, and they are able to apply it (Fadillah, 2017). Authentic assessment as one of the results of the assessment approach can be used as an alternative solution in assessing student learning development more comprehensively and objectively considering accurately reflecting and measuring what we value in education. Authentic assessment is a reflection of the real world. This means that all activities carried out by students in an effort to achieve competency must be directed towards contextual, comprehensive and holistic activities. Therefore, assessment must involve all areas of competence, namely cognitive, affective, and psychomotor.

Students must be trained to be able to think logically, coherently and systematically, using HOTS capacity (Archer & Hughes, 2011; Poluakan & Tilaar, 2018; Sinaga et al., 2018). To be able to fulfill bills with HOTS type, students must have good reasoning or thinking skills (Guth, 2016). One way to practice students' reasoning skills is through learning strategies and specially designed assessment activities. Students who are accustomed to completing these bills indirectly will develop the reasoning process (Tofade et

al., 2013). The problem, faced by teachers, is that there are still a few bills that are specifically HOTS-oriented. Implementation of assessments in learning is a curriculum requirement, especially in tertiary institutions. In essence, authentic assessment is a comprehensive assessment that illustrates students' abilities, achievements, motivations, and attitudes to relevant learning. This assessment requires teachers to be creative and innovative so that they can develop instruments to measure students' abilities in a better way (Afrianto, 2017; Fitriani, 2017; Rukmini & Saputri, 2017). For this reason, a HOTS-authentic assessment model is needed, in this case, tissue structure materials in the high school of Malang.

Several studies related to this theme have previously been carried out in Indonesia and several other countries. But this is with a special note that what is meant is research "officially published in the form of journal articles, conference proceedings, and research reports". Research must be carried out at the high school level. Afandi et al. (2019) has developed interactive questions to measure the HOTS of senior high schools' students. His research aims to find out the validity, practicality, and effectiveness of interactive questions in measuring students' HOTS. The study showed that the expert validation results were very high category; the instrument was considered as good by teacher responses; and the interactive questions were effective in measuring students' HOTS. Ichsan et al. (2019) has developed Higher-Order Thinking Skills Assessment based on Environmental Problem (HOTS-AEP) at the elementary school level. The conclusion of this study is that HOTS-AEP is appropriate to be used as an evaluation of learning for students at the elementary school level. Narendra (2019) developed a HOTS-based assessment instrument on basic competencies Applying the Class X-Journal Book in Accounting subjects in vocational school. The conclusion is that all items about applying a journal book deserve to be an instrument for educators in learning to know the mastery of basic competencies in applying a journal book.

Meanwhile, Khoiriyah et al. (2018) produce an assessment instrument that meets the eligibility criteria as a HOTS assessment instrument. The research concluded that the HOTS assessment instrument of development result has fulfilled the eligibility criteria as HOTS assessment instrument. The results of Ramdiah et al. (2019) research showed that the senior high school biology teachers in Banjarmasin have prepared the lesson well, but this was not done consistently (continuously). Some teachers have not maximally prepared the lessons according to the recommended educational standards. The teacher's understanding of HOTS is broad enough, and they assume that HOTS really needs to be trained to students. While the results of Perdhana and Hariyatmi's (2019) research shows the profile of biology learning instrument assessment grade X even semester in Muhammadiyah high schools in Surakarta City 2018/2019 academic year in the good category (76.39%), although it does not provide a description of whether HOTS or not.

Therefore, reflecting from some of the previous studies, this research is still very necessary and crucial to do. The model produced by this study will have relevance and significance to efforts in order to improve the quality of learning, especially in preparing teachers who have HOTS ability. This study aims to: 1) analyze the efforts of high school teachers in Malang in developing the HOTS-authentic assessment in tissue structure materials; and 2) analyze the pre-validation final draft of HOTS-authentic assessment model in the tissue structure materials in high school of Malang.

The findings of this study are expected to be a guide in the application and preparation of HOTS-based authentic assessments. In addition to this, as a result of research that can provide additional treasures of knowledge regarding the HOTS-authentic assessment model so that it can provide wider benefits for the development of knowledge, especially in the field of learning in high schools and universities.

METHOD

Types of research

The research model used is the Research and Development (R&D). The development model in this research and development uses the Four-D model modifications (define, design, develop, and disseminate) based on Thiagarajan et al. (1974). However, in line with the objectives, this publication only focuses on define, design, and develop. The develop part is only on the product in the form of a final draft (before validation by experts). The research consists of several sequential or simultaneous activities, namely Library Research; conduct interviews and discussions with peers and teachers; conduct field research on implementing the initial model; conduct an initial model analysis with an analysis of strengths, weaknesses, opportunities and threats to perfect the initial model; formulation of the final draft (pre-validation) model of the application of authentic HOTS-authentic assessment on the Biology Learning of Tissue Structure Materials.

Location, Time, and Research Subject

The research was carried out in State Senior High Schools (SSHS) in Malang City (SSHS 1, 3, 4, 7, and 8), especially in the subject of tissue structure biology. The study was conducted in April-November 2018. The subjects of this study were 2 biology teachers each from each school (10 teachers in total).

Types of Data

The types of data in this research are qualitative data. Qualitative data obtained from the analysis of curriculum/syllabus/lesson plan needs and study of animal ecology learning documents so far, data from observations and interviews, data from literature review, teacher's notes, and validator.

Data Analysis

Analysis of the data in this study uses a qualitative paradigm and is supported quantitatively. Data and findings on the need for the development of HOTS-based authentic assessment instruments based on the characteristics and demands of learning achievements of Tissue Structure Materials were analyzed by descriptive-analytic qualitative. Furthermore, the steps of data analysis and report writing are carried out by overlapping between data collection, data reduction, data presentation and writing research report.

RESULTS AND DISCUSSION

Teacher's efforts in developing HOTS-authentic assessments in tissue structure materials

Learning biology in a special high school in class XI, there are 14 KD which are charged to teachers to be taught. Thus, it can be said that the Tissue Structure Materials has a major contribution in determining the development of HOTS aspects of students. Specifically, in High School in Malang City, based on the results of observations and initial interviews with biology subject teachers, it was found that the teacher had difficulty in teaching Tissue Structure Materials. Thus, the teacher is needed the development of learning that accommodates the development aspects of HOTS. Teachers have sought to apply Student Centered Learning (SCL) learning innovations with methods of cooperative learning, discovery learning, problem-based learning, and inquiry learning. However, teachers have not yet developed an authentic assessment model based on HOTS. So far, there is only the task of making papers, middle-test questions, and final-test questions. The material used is also just a learning package book and worksheets.

In its development, the teacher has a product in the form of a lesson plan. The lesson plan is partly the result of the Biology Teachers Forum (*Musyawarah Guru Mata Pelajaran* or MGMP) that are modified according to the needs or targets that the teacher wants to

achieve. Some are used/implemented by teachers without modification (this condition is often done by teachers because of limited time and tight working hours/teaching hours). The teacher will modify the device if it has a partner, for example together with other biology teachers at the school, as well as student students (PPL/Internships) from various campuses in Malang, namely Universitas Muhammadiyah Malang, Universitas Negeri Malang, Universitas Kanjuruhan and others.

Currently, there is a Higher-Order Thinking Skill-Oriented Assessment Book (*Buku Penilaian Berorientasi Higher-Order Thinking Skill*) published by the Directorate General of Teachers and Education Personnel through the Directorate of Basic Education, the Ministry of Education and Culture of Indonesia. Book written by Setiawati et al. (2018) is a reference guide for educators, principals, supervisors, and parties involved in the administration of education so that they have an understanding that is in line with the policies of the Ministry of Education and Culture, especially with regard to HOTS assessments. Through this handbook, educators are expected to not experience significant obstacles in its application. This book is an optimal effort to facilitate the implementation of HOTS-based assessments, but it will all depend on the sincerity, attitudes and skills of principals, educators, school supervisors, and the Office of Education in implementing them. In this case, the change in mindset of the school principal, educators, school supervisors, parents, and stakeholders, related to various developments in the assessment system are prerequisites for the successful implementation of HOTS-based assessments. Also based on the results of the analysis of the book, the book is not operational, is still too shallow/simple, and is more focused on how the teacher arranges HOTS-oriented questions. While the authentic aspects of HOTS holistically have not been contained in the book.

The research team has conducted a study and analysis of lesson plans and learning tools (which also includes the type of assessment used by teachers). Djumhana (2008) explained that the lesson plan has benefits in the teaching and learning process, namely: (1) as a direction for activities in achieving the goals; (2) as an archetype in regulating the duties and authorities for each element involved in the activity; (3) as a work guideline for each element, both teacher and student elements; (4) as a measure of whether or not a work is effective, so that the accuracy and delay of work are known at all times; (5) as material for data preparation so that there is a work balance; (6) as a saver of time, energy, tools and costs. Therefore, learning is carried out in accordance with teaching programs that have been made previously in the form of lesson plans.

The results of the analysis of the lesson plan and in relation to the learning methods and assessments used by the teacher are presented in Table 1. The results of the analysis of the lesson plan prepared by the teacher and in relation to the learning methods and assessments used by the teacher as presented in Table 1 shows that the teacher has included or considered aspects of the HOTS in the lesson plan. However, the development of HOTS aspects and their assessment were not able to be carried out maximally by the teacher.

This condition is supported by the teacher's reflective notes and statements when discussing or being interviewed by the research team, as follows: (1) First reflection: Difficulties faced by the teacher with student character like this are civilizing students to think critically and systematically (HOTS), as well as creating a lively atmosphere in the classroom for learning. Because the culture of student literacy is still low, it can be seen from their questions that the answers are actually already in their handbooks. Therefore, an interesting learning plan is needed to provide stimulus for students to be more involved with the learning process in class. The teacher's assertiveness and more intensive attention to each class member are also important so that students' questions will be accommodated. (2) Second reflection: Difficulties faced by teachers with student character like this are to civilize students to think critically, systematically, and create an atmosphere of enthusiasm in the classroom for learning. Because the culture of student literacy is still low, it can be seen from their questions that the answers are actually already in their handbooks. It is necessary to

design a learning plan that emphasizes strengthening the learning process as a group and a strong stimulus for students to read the learning material because the learning process is still not optimal so that the learning objectives are also not fully achieved. More detailed planning efforts are needed to increase student involvement in the whole learning process both individually and in groups. (3) Third reflection: Proper learning will be able to develop students' critical and creative thinking skills in analyzing the relationship between cell structure in animal tissue with organ function and skilled in communicating the results of tissue and organ structure observations in animals in the form of reports on the results of group collaboration. These goals must be achieved by students and need to be assessed/assessed. Aspects of critical thinking, creative, the ability to analyze and problem solving must be maximized.

Tabel 1. Results of lesson plan analysis

No	KD	Indicator	Model	Method	Type of assessment	Assessment techniques	Instrument's Shape	Assessment instrument
1	3.3 Analyzing the relationship between cell structure in plant tissues and organ function in plants 4.3 Present data on the results of observations of tissue structures and organs in plants	3.3.1 Describe the types of plant tissue 3.3.2 Describe the location, structure and function of plant tissue 4.3.1 Make mind mapping of plant tissue.	*Problem Based Learning (PBL)* and *mind mapping*	lectures, discussions, assignments	Cognitive	Test	Question	✓ Question description sheet ✓ Cognitive assessment rubrics
					Affective	Non-Test	Observation	✓ Observation sheet ✓ Affective assessment rubric
					Psychomotor	Non-Test	Observation	✓ *mind mapping rubrics*
	DESCRIPTION: DO NOT ENTER THE HOTS CATEGORY							
2	3.3 Analyzing the relationship between cell structure in plant tissues and organ function in plants 4.3 Present data on the results of observations of tissue structures and organs in plants	1.3.1 Determine the type of tissue making up vegetative organs (roots, stems, and leaves) and generative organs (flowers, fruits, and seeds). 1.3.2 Analyze the relationship between the structure of the constituent tissue of vegetative organs (roots, stems, leaves) with their functions 4.3.1 Identify various types of tissue making up organs in monocotyledonous and dicotyledonous plants through microscope observation 4.3.2 Make sketches / images of cross sections / longitudinal organs of roots, stems, leaves, from the results of microscopic observations	Guided Inquiry	practicum, lecture, discussion, question and answer, assignment, and talking stick	Affective Cognitive Psychomotor	Non-test Test Non-test	Observation Written test Observation	Observation sheet Multiple choice Observation sheet and practicum assessment
	DESCRIPTION: ENTER THE HOTS CATEGORY, BUT IT ISN'T MAXIMUM IMPLEMENTATION							

No	KD	Indicator	Model	Method	Type of assessment	Assessment techniques	Instrument's Shape	Assessment instrument
3	3.3 Analyzing the relationship between tissue structure and plant organ function 4.3 Present data on the results of observations of the anatomical structure of plant tissue to show its relationship with its location and function in bioprocess	3.3.3 Identify the types of permanent (adult) tissue in plants. 3.3.4 Analyze the structure of permanent (mature) tissue in plants with their functions 4.3.1 Sketch / draw a cross section / longitudinal organs of roots, stems, and leaves from microscopic observations. 4.3.2 Present data from the analysis of the structure of the permanent tissue (adult) with its function in the form of practical reports	Guided Inquiry	observations, discussions, presentations, and lectures	Cognitive Psychomotor Affective	Test Non-test Non-test	Written test Observation Observation	Essay Assessment Sheet Using a Microscope The assessment sheet sketches Affective Assessment Sheet
	DESCRIPTION: ENTER THE HOTS CATEGORY, BUT IT ISN'T MAXIMUM IMPLEMENTATION							
4	3.3 Analyzing the relationship between cell structure in plant tissues and organ function in plants. 4.3 Present data on the results of observations of the anatomical structure of plant tissue to show its relationship with its location and function in bioprocess	3.3.5 Linking the totipotency of tissue with plant tissue culture.	Guided Inquiry	observations, discussions, presentations, and lectures	Cognitive Affective	Test Non-test	Written test Observation	Essay Presentation assessment sheet Affective assessment sheet
	DESCRIPTION: ENTER THE HOTS CATEGORY, BUT IT ISN'T MAXIMUM IMPLEMENTATION							

Based on the three teacher reflections related to the tools that have been developed (lesson plans and assessment tools) and the learning process that has been carried out, it is necessary to help teachers maximize the development of HOTS aspects as well as how to carry out HOTS authentic assessments on tissue structure material at high school in Malang. This is supported by the awareness of subject teachers at high school in Malang that as a teacher he must continue to learn, update knowledge and skills, and include learning and implementing learning models that have a positive impact on their students.

According to Tjipto (2013), the duties and responsibilities as a teacher must be upheld in managing positive, dynamic, effective and efficient learning. Therefore, increasing teacher professionalism is a very basic and important thing to improve the quality of education. The potential of the teacher's resources needs to be continuously developed in order to be able to perform its functions optimally. In line with that, according to Lodang et al. (2011), teachers in general basically already know all types of assessment techniques, but do not apply other assessment techniques they know, so to know student achievement tends to be done with tests written in the form of descriptive questions, multiple choice questions and answer questions.

Therefore, it is necessary to provide assistance by relevant parties so that teachers have more awareness and maximize their abilities or potential.

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The pre-validation final draft of the application model of HOTS-authentic assessment in tissue structure materials

In line with the findings that have been stated previously, it can be said that so far the biology teacher at high school of Malang has been trying to implement lesson plans and assessments in the learning they carry out, the lesson plan is largely the result of discussion or work or collaboration of the teachers in MGMP. In practice, a greater percentage of teachers simply use the lesson plan without modification or without making adjustments to the conditions of students and various other factors in the school. The teacher said that they modified and included HOTS elements when there was an opportunity to discuss with fellow biology teachers at high school of Malang. The opportunity to modify lesson plans and assessment techniques accordingly is when there are students who practice (internship). The teacher will guide or share with students so that lesson plans and appropriate assessment techniques (authentic assessments) are arranged.

In connection with that, the School Lecturer Assignment (*Penugasan Dosen di Sekolah* or PDS) program organized by the Faculty of Teacher Training and Education of the Universitas Muhammadiyah Malang last two years provides the opportunity for teachers to deepen their abilities and correct deficiencies in the preparation of devices and their implementation in classroom learning. This situation can be visualized simply as in Figure 2.

These concepts are related to the Biology Subject MGMP activities, in an interactive and cyclical relationship so as to form a Model of Biology Teacher Professionalism Development in the Implementation of HOTS Authentic Assessment. This model can be visualized, as shown in Figure 3.

The thing that needs to be strengthened or confirmed in order to later become a program that is continuously being implemented is the PDS. According to biology teachers at High School of Malang City this program is very beneficial for them because it can improve their professionalism in implementing learning, especially in this case is related to the implementation of HOTS-authentic assessment. One form or concrete evidence of the results of this activity is the existence of learning which results are published in scientific journals.

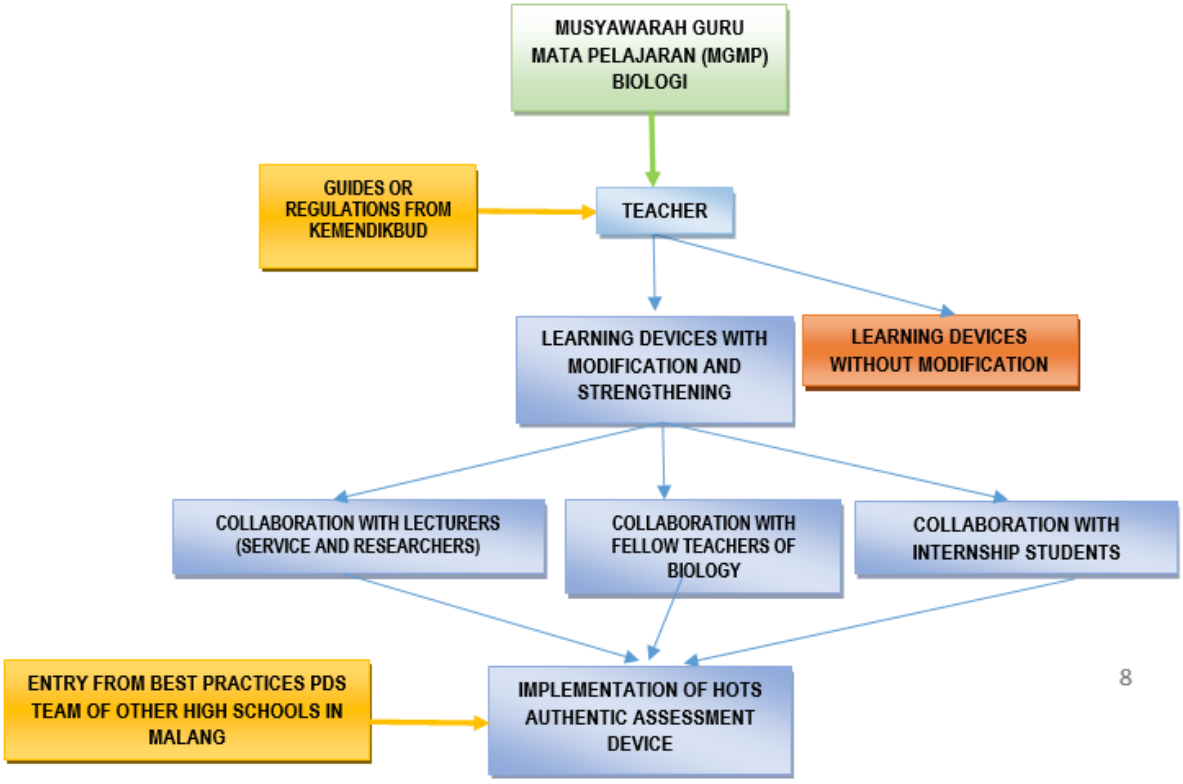

Figure 2. Model of application of HOTS-authentic assessment by teachers (notes: MGMP is *Musyawarah Guru Mata Pelajaran* or the Teachers Forum).

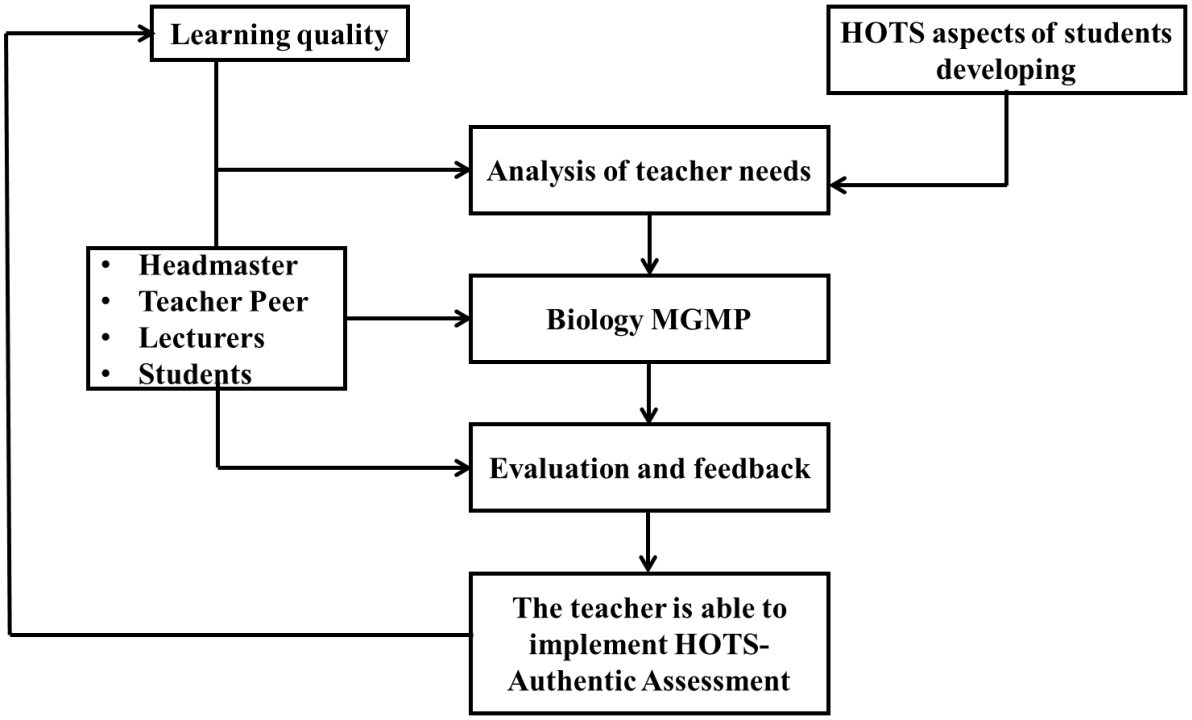

Figure 3. Model of professional development of biology teachers in implementing HOTS-authentic assessment

This condition is certainly in line with the PDS achievement targets as according to the Direktorat Pembelajaran (2018), namely PDS encourages the development of collaborative learning tools between lecturers and partner teachers, the implementation of collaborative learning, and the gaining of good and reported experiences. PDS is an accompaniment to the achievement of the quality of learning through PDS with indicators, the creation of a better

learning climate, the production of increasingly quality learning tools, and an increase in student learning achievement. PDS encourages collaborative work between teachers and lecturers. According to Gerlach (1994) Collaborative work is a process of cooperation carried out by both individuals and between groups, which are attentive and respectful of fellow members to achieve common goals. Collaborative learning activities are directed at instilling habits to understand what is learned, the attitude of wanting to do something, and the skills of how to do something.

The PDS program encourages lecturers to present real experiences on how to carry out good learning, which is relevant to the demands of the quality of the learning process at school. The PDS program contains multifunctionality in improving teacher quality, including downstreaming various research findings on campus to the Laboratory School and/or Partner School related to the rapid development of educational science and learning and learning theories. The PDS program encourages teachers to share experiences with lecturers, increase insight in choosing and using various learning models with lecturers, add skills to overcome learning problems, and refresh and broaden knowledge about learning theories in schools. This program also builds the consistency ability of teachers in making learning plans, the ability to guide individual and group learning, the ability to guide small group and large group discussions, increasing maturity in the form of growing an open attitude towards constructive input, and the skill of finding problems.

CONCLUSION

The results of the analysis of efforts of high school teachers indicate that teachers have included or considered aspects of HOTS in their lesson plans. However, the development of HOTS aspects and their assessment were not able to be carried out maximally by the teacher. In practice, in a greater percentage, teachers use lesson plans without modification or without making adjustments to student conditions and various other factors at school. They modify and incorporate elements of HOTS if there is an opportunity to discuss with fellow biology teachers or other parties who guide them. Therefore, the existence of this model is very necessary / needed by the teachers. The pre-validation final draft is essentially in the form of concepts that can be linked to the Biology teacher MGMP activities, and various related parties, in an interactive and cyclical relationship so as to form a model of professional development of biology teachers in the Implementation of HOTS-Authentic Assessment.

RECOMMENDATION

This research is still being carried out at the development stage and has not yet been conducted valiadiation. This provides the possibility to develop at a lower level of education, or at different types of schools, or on different subjects. This is opportunities to develop authentic aspects of assessment are also still wide open.

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