

Classroom-Based Assessment of Science in the Context of Malaysia

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ABSTRACT

The 21st-century assessment system requires a student centralised assessment instead of a traditional assessment system. Traditional assessment is found to be a limiting factor in student classroom engagement during Teaching and Learning. This study sheds light on concepts of assessment and measurement of the Science subject implemented today. The assessment and evaluation conducted in Malaysia comprise two types which are School-Based Assessment and Classroom-Based Assessment. The change of assessments in Malaysia from School-Based Assessment to Classroom-Based Assessment namely involves the Science subject too. The change in assessment encompass activities used in assessments, application of assessments in Science, issues and problems faced in the assessment of Science as well as an update on its implementation that differs from the previous ones. This study also provides a focus on the differences between School-Based Assessment and Classroom-Based Assessment in Science. This difference is shown in a series of pros and cons of the Classroom-Based Assessment which replaced the School-Based Assessment in Malaysia's education evaluation system. This discussion is done thoroughly to ensure the effectiveness and challenges in conducting Classroom-Based Assessment is capable of polishing students' potential holistically in the teaching and learning of science in the 21st century.

Keywords: Science Education, Classroom-Based Assessment, School-Based Assessment

INTRODUCTION

Assessment is a learning process that goes through recording, scoring, measuring, and summarizing the level of student achievement (Opre, 2015). Assessment is divided into two categories, namely formative assessment and summative assessment. Formative assessment means an ongoing process of monitoring and evaluating student performance. Summative assessment is an assessment done formally at the end of a teaching topic to grade student achievement (Azizi Alias & Kamisah Osman, 2018). Assessment for science involves formative and summative assessment applied in Learning and Teaching (T&L) (Ministry of Education Malaysia, 2017b). Two methods of assessment that have been recognized by the Ministry of Education Malaysia (MOE) in science are School-Based Assessment and Classroom-Based Assessment (Examination Board, 2014b).

School-Based Assessment is implemented when a change occurred in the content of the *Kurikulum Bersepadu Sekolah Rendah (KBSR)* to *Kurikulum Standard Sekolah Rendah (KSSR)* in 2011. The School Based Evaluation introduced are made up of two categories which are academic and non-academic (Mohd Azeman Sailin, 2013). The academic category covers the components of Central Assessment/*Pentaksiran Pusat* (PP) and School Assessment/*Pentaksiran Sekolah* (PS). As for the non-academic category, it consists of the assessment for Physical Education component (*Pentaksiran Aktiviti Jasmani Sukan dan Kokurikulum (PAJSK)*) and Psychometric Assessment/*Pentaksiran Psikometrik (PPsi)*. Central Assessment is an examination that is administered by the school, District Education Office (*Pejabat Pendidikan Daerah*), State Education Department (*Jabatan Pendidikan Negeri*) or the Examination Board (*Lembaga Peperiksaan*) which involves a process of recording, reviewing and instruments that adopt guidelines set by the Examination Board in the form of grading and equivalent scores (Mat Loddin Noraini & Abdul Kadir Suhaida, 2013). While school assessment is an assessment that is administered and planned by the school and conducted by its teachers. Teachers construct, administer, inspect and record the assessments conducted. School assessments consist of two types, which are assessment as learning and assessment for learning (Examination Board, 2014a).

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School assessment uses performance standards in determining grades for examinations and determining student achievement by utilizing a Band scale of one to six (Band 1-6). The determination of student achievement by Band includes a general statement of what students have achieved from Band 1 to Band 6 which is based on evidence of performance in accordance with mastery of learning content (Examination Board, 2014a). PAJSK is the assessment conducted by the school to students on sports activities, co-curriculum and extra co-curriculum. The PAJSK marks for every student is measured using the National Physical Fitness Standard Instrument/ *Instrumen Standard Kecergasan Fizikal Kebangsaan (SEGAK)* and Body Mass Index (BMI) as an evaluation and activity report of the students' fitness level throughout the year. While PPSi is an assessment conducted on students in measuring personality, attitudes, interests, inclinations, problem solving skills and thinking skills conducted at the school level or central level.

In these recent years, evaluation was carried out using the Classroom-Based Assessment. Classroom-Based Assessment is implemented in 2019 with the involvement of primary school students' level one only at this time (Ministry of Education Malaysia, 2018). It is a process to obtain data related to the development, progress, abilities and mastery of students to achieve learning objectives in the classroom. The Curriculum Development Body (2019) stressed that the Classroom-Based Assessment implemented is used to obtain information on student development and analyze it to make improvements. The process of obtaining this information is a continuous form of feedback towards the improvement and enhancement of the implementation of assessment and student development. The implementation of Classroom-Based Assessment is according to the method that is appropriate for the teacher in the classroom in order to have an impact on the level of mastery of students.

The information of mastery level obtained from Classroom-Based Assessment is very useful for the progress and development of the students who are assessed and is not intended to be used as a comparison between weak students and good students. All information in the Classroom-Based Assessment is used by subject teachers, schools and parents to make follow-up plans to improve the level of mastery and achievement of students (Curriculum Development Division, 2019). Subject teachers who act as implementers in each curriculum, especially Classroom-Based Assessment, need to determine the objectives of teaching and learning implemented according to learning standards. This is important because teachers need to evaluate and plan to produce classroom assessment instruments, to administer the assessment, record, and analysis of assessment information. This information is used by teachers as a report in making follow-up actions on students' mastery of learning (Curriculum Development Division, 2019). Classroom-Based Assessment specifically refers to formative and summative assessment, namely assessment for learning, assessment as learning and assessment of learning. Classroom-Based Assessment is important in education because it can improve various aspects of teaching and learning such as pedagogical methods of teaching and learning, the use of teaching and learning aids, improve the level of learning and make follow-up action to students who are weak in each subject (Yates & Johnston, 2018). Classroom-Based Assessment is an assessment that is fully implemented by subject teachers including science subjects that covers aspects of lesson planning, assessment, scoring, recording and reporting (Zahari Suppian & Jamil Ahmad, 2014). The curriculum of science subject is formulated to develop students' creativity and interest in experiential learning, discovery and investigation to master the concepts of science, thinking skills, scientific skills, scientific attitudes and values in line with 21st Century Learning (Ministry of Education Malaysia, 2017b). Therefore, the focus of Classroom-Based Assessment in science is based on the KSSR which differs from any other subject in ensuring that students are able to fully master the set content standards.

Classroom-Based Assessment in Science

Classroom-Based Assessment implemented in science subjects is used to measure the level of development and mastery of students by using formative and summative methods of assessment in the classroom (Ministry of Education Malaysia, 2017b). The development of students in Classroom-Based Assessment is guided by the content standards of the science curriculum to determine the standards of student performance in each chapter and learning theme. The standard of student performance contained in the *Dokumen Standard Kurikulum dan Pentaksiran (DSKP)* is divided to the three main components assessed, namely the concept of scientific knowledge, scientific skills, scientific attitude and noble values to identify the Level of Mastery of students (Level of Mastery 1-Level of Mastery 6). The assessment of science knowledge in a theme or chapter is linked together with the assessment of science process skills. Assessment of knowledge is done at all times during teaching and learning in the classroom according to the suitability of the chapters taught while science process skills are done throughout the year through the professional judgment of teachers (Ministry of Education Malaysia, 2017a). Table 1 listed below shows the Level of Mastery value of knowledge and science skills in the classroom-Based Assessment of science subject.

TABLE 1
Level of Mastery of Science Knowledge and Skills

Level of Mastery	Interpretation
1	Students can recall learning through applied scientific knowledge and basic scientific skills.
2	Students can renew understanding of learning through scientific knowledge and basic scientific skills as well as explain their understanding of teaching and learning to teachers.
3	Students can reapply learning through scientific knowledge and basic scientific skills to perform simple tasks given by the teacher in class.
4	Students can reanalyse learning through scientific knowledge and basic scientific skills in the aspect of problem solving.
5	Students can re-evaluate learning through scientific knowledge and basic scientific skills through problem-solving aspects and decision making in performing tasks requested by teachers.
6	Students can reinvent learning through scientific knowledge and basic scientific skills in the aspect of problem solving and can make decisions or be able to perform tasks in a variety of new situations or be able to create tasks creatively and innovatively.

Assessment of scientific attitudes and values of students in Classroom-Based Assessment is measured throughout the year by subject teachers to give students the opportunity to achieve the highest Level of Mastery and be able to make knowledge and skills as practice and culture (Norsyuhadah Maskan, 2013). Table 2 below shows the Level of Mastery translation for scientific attitudes and values in Classroom-Based Assessment of Science subject.

TABLE *Error! No text of specified style in document.*
Interpretation of Mastery Levels for Scientific Attitudes and Moral Values

Level of Mastery	Interpretation
1	Students' interest in science subjects
2	Students' interest and curiosity in science
3	Students have interest, curiosity, honesty and accuracy in recording scientific data
4	Students have interest, curiosity, honesty, accuracy, systematic in recording scientific data and bravery to try
5	Students have interest, curiosity, honesty and accuracy in recording science data, bravery to try, systematic, cooperative, diligent and perseverance in carrying out tasks assigned by the teacher in the classroom
6	Students have interest, curiosity, honesty and accuracy in recording scientific data, bravery to try, systematic, cooperative, diligent and perseverance in carrying out the tasks assigned by the teacher and have responsibility towards themselves, classmates, environment and highly prudent

Science teachers need to play a role in the implementation of Classroom-Based Assessment to ensure that students are able to master each learning content according to the Level of Mastery table set. In designing teaching and learning of Science, teachers need to first set learning objectives based on the learning standards assessed, recording assessments, analysing information, reporting and making follow-up actions for assessment of student performance (Hill, 2017).

Application of Classroom-Based Assessment in Science

Classroom-Based Assessment in science subjects is a continuous assessment process to obtain information related to the development of student progress, student abilities and student achievement (Mohd Haidzir

Yusof@Jusoh & Norasmah Othman, 2019). Classroom-Based Assessment in science subjects involves teaching and learning which includes assessment of knowledge, skills, attitudes and scientific values. Classroom-Based Assessment in science subjects is a continuous assessment in teaching and learning to obtain information related to the development of student progress, student abilities and student achievement (Mohd Haidzir Yusof@Jusoh & Norasmah Othman, 2019). Classroom-Based Assessment in science subjects involves teaching and learning which includes assessment of knowledge, skills, attitudes and values. These assessments can be conducted with a variety of activities such as simple projects, quizzes, games, role-playing and storytelling in lieu of centralized or traditional examination-based assessments. Student work in the form of a project will be evaluated as examination assessment which will be translated to the student's Level of Mastery. Level of Mastery of science students in knowledge, scientific skills, scientific attitudes and values as a whole is done by the professional judgment of teachers (Curriculum Development Division, 2019). It will be assessed via an assessment standard known as the general Level of Mastery of KSSR science which is classified into Level of Mastery 1 to Level of Mastery 6 as in Table 3 below.

TABLE 2
Mastery Level of KSSR Primary School Science

Level of Mastery	Interpretation
1	Students are knowledgeable on the basics related to science knowledge and skills as well as show interest in teaching and learning of science or can implement the basic skills of science concepts or respond well in the basics related to science knowledge for a topic taught in class.
2	Students can respond and understand science knowledge and skills as well as show an understanding of the science taught by being able to explain a topic orally while showing a deep curiosity.
3	Students can apply science knowledge and skills learned in class to perform simple tasks honestly and are able to record science data accurately in tasks or situation in the classroom.
4	Students can analyze science knowledge and skills learned in teaching and learning in the context of systematic problem solving and bravery in trying new things.
5	Students can evaluate science knowledge and skills to implement science process skills on assignments for problem solving situations and make decisions according to procedures in a systematic, analytical, collaborative, diligent and persevering manner in the classroom.
6	Students are able to create in relation to science knowledge and skills in the context of problem solving and make decisions in a variety of situations creatively and innovatively in order to generate new ideas. Students also have exemplary qualities, responsible for themselves, friends, the environment and highly prudent.

Table 3 above shows the Level of Mastery that needs to be mastered by students in science subjects. Before this general Level of Mastery of science is given in Classroom-Based Assessment, students are first assessed the Level of Mastery of knowledge, scientific skills, scientific values, and attitudes in T&L with various assessment instruments used. The analysis of the general Level of Mastery findings of this Classroom-Based Assessment can be translated in more detail through Figure 1 below.

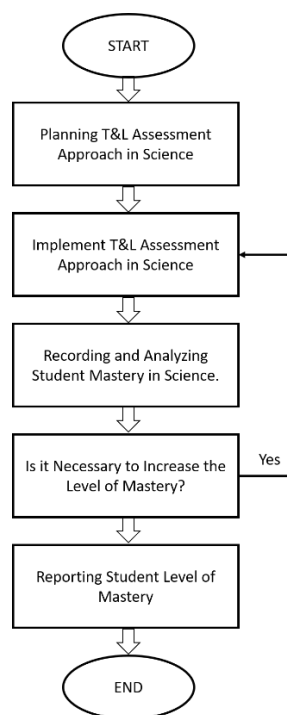


Figure 1. Level of Mastery Reporting Analysis Flowchart

The determination Level of Mastery of a pupil's science in Figure 1 begins with T&L planning and assessment methods. The main point of this planning is to determine the objectives in the T&L of science that needs to be achieved in line with the content and learning standards. This process is then followed by identifying the assessment methods that will be used in the T&L. Having a teaching and assessment plan, implementation is carried out on T&L and assessment through various T&L activities such as simple projects, quizzes, games, role play, and storytelling. T&L activities conducted in this class can be assessed by observation, oral or written. Next, the third thing in Classroom-Based Assessment that needs to be done is to record and analyse the mastery of students in various forms such as the way of making a statement, marking with symbols, give marks or grades. These notes and analyses can be written in teaching record books, teacher notebooks, checklists, or Classroom-Based Assessment reporting templates. This recording and analysis need to be done continuously in the T&L of science to determine the Level of Mastery of knowledge, scientific skills, scientific attitudes, and values that will be translated into the General Level of Mastery of science. If it is found that the Level of Mastery has not yet reached the minimum mastery set and needs to be improved, follow-up action will be implemented to ensure that the T&L and assessments implemented are improved. Finally, after having all the required Classroom-Based Assessment information, the science teacher will make an overall general Level of Mastery related report. This student's General Level of Mastery is current assessment information about the student's progress of knowledge, skills, values, attitudes, and achievements in science to be reported to parents or stakeholders. Overall General Level of Mastery in Classroom-Based Assessment in this science is only generated twice a year through the analysis of student performance records in T&L throughout the year (Curriculum Development Division, 2019).

The effectiveness of the implementation of Classroom-Based Assessment depends on the ability of science teachers to understand related knowledge and skills emphasized in implementing the assessment (Khalil Fakhri Abdul & Awang Mohd Isha, 2016). Mastering assessment through effective training will directly correlate with student outcomes in learning (Koloji - Keaikitse, 2016). In this regard, the importance of teachers in mastering, understanding, practicing and appreciating how the implementation of Classroom-Based Assessment in science subjects as a whole to ensure its successful implementation and students are developed in line with the aspirations of the National Education Philosophy (NEP).

Issues and Problems in Classroom-Based Assessment of Science

Classroom-Based Assessment in science is a round-the-clock assessment process to measure the level of mastery of knowledge and skills as well as mastering the content of science subjects which includes knowledge of science concepts, scientific skills, scientific attitudes and values as well as thinking skills. This requires teachers to provide themselves with a variety of knowledge, skills, training support, professional values and attitudes relevant to Classroom-Based Assessment (Siti Nor Aisah Moktar, 2019). It is found that science

teachers who are proficient in assessment skills, has good time management and a reduced workload are able to conduct Classroom-Based Assessment effectively.

The issue overcrowding of students in the classroom also plays a big role in the effective implementation of Classroom-Based Assessment because teachers need to evaluate each student individually (Siti Nor Aisah Moktar, 2019). The more students taught, the higher the teacher's workload to ensure all students are assessed accurately and fairly in determining their respective Level of Mastery. Issues and problems regarding Classroom-Based Assessment arise in teachers who are not knowledgeable, master nor understand the principles and its concepts, thus hindering its implementation (Alena, 2015). Teachers who do not understand the principles and concepts of Classroom-Based Assessment are not able to perform assessment efficiently and effectively. Among the causes of inefficiency that occurred is lack of teacher training in skills of assessment which results in student development not being assessed accurately and fairly (Hall et al., 2015). This weakness causes inability in the science teachers to follow up and improve. Without effective solutions to these issues and problems, science teachers are also unable to determine accurate and effective assessment strategies in accordance to the standards and content of science subject in the classroom (DeLuca et al., 2012). Therefore, science teachers who are implementers in Classroom-Based Assessment must fully master the strategies, skills and knowledge of conducting assessments.

The failure of science teachers to master assessment strategies in effectively assessing and evaluating student achievement performance can inhibit key goals in science KSSR (Fakhri Abdul Khalil & Mohd Isha Awang, 2016). Therefore, teachers need to always reach out for opportunities, be open-minded, motivated, and willing to accept any changes designed to understand all types of assessment (Leifler, 2020). Acceptance of any changes in assessment guidance and training in the new approach can develop competencies and increase teachers' understanding (Shariffah Sebran Jamila Syed Imam et al., 2019). Positive competencies and attitudes in assessment makes the science teacher more competent and prepared in aspects of knowledge and skills (Kim et al., 2019). Overall, in order to improve the ability of teachers to implement Classroom-Based Assessment at all school levels, the readiness and competence of a science teacher should be given utmost priority so that all issues of weaknesses, obstacles and problems in its implementation can be overcome.

Reforms in Assessments of Science

Rapid changes in the world's education system, especially in this era of sophisticatedly advanced science and technology, are influencing education policy makers to provide a competitive workforce. The provision of highly skilled workforce in problem solving, strong critical thinking and decision-making skills can be developed into formative or performance-based assessment systems (Mazura Mahdzir et al., 2021). Because of the changes that occurred, MOE, being the most influential body in Malaysian education needs to equip students with science and technology skills as well as 21st century skills (Rohaida Mohd Saat et al., 2016). Therefore, KPM through the Malaysian Education Development Plan (PPPM 2013-2025) has improved the assessment framework by emphasizing High Order Thinking Skills (HOTS) in Classroom-Based Assessment to ensure that Malaysian education is on par with international standards. The emphasis of HOTS in the concept of science, scientific skills, moral values and scientific attitude through PPPM 2013-2025 makes the assessment system for science more relevant, authentic and in line with 21st century skills (Azizi Alias & Kamisah Osman, 2018). Thus, the reforms in the assessment of science is not just to equip students with knowledge and basic skills only.

The authentic nature of this assessment system emphasizes on assessments of analysis, problem solving and decision making. With this, it has given students the opportunity to highlight their true talents and potential by not just relying on cognitive achievement alone (Ab. Halim Tamuri, 2014). In determining student achievement, assessments should not rely on only summative evaluation and science teachers may diversify the daily assessment methods in the teaching and learning sessions conducted. Utilising a variety of assessment methods is of high importance as it allows Malaysian educational institutions to shape students that are equipped with 21st century skills thus expanding their individual potential and intelligence.

Science education in Malaysia previously placed a lot of emphasis on assessments and mastery of basic knowledge and skills as opposed to providing students with 21st century skills (Mohamad Natrah et al., 2019). The transformation of education in PPPM 2013-2025 changes the content of the curriculum to be in line with international standards that allows higher flexibility and in line with current needs. Thus, assessments in science nowadays do not only include scientific skills and knowledge but cross-curricular elements such as HOTS and entrepreneurship were also embedded together (Yahya Mohd et al., 2015). Each of these additional elements is important to ensure that students develop in potential to be highly competitive and holistic in preparing themselves towards the career market in accordance with the changing currents of the world of science and technology today.

Comparison between School-Based Assessment and Classroom-Based Assessment of Science

The implementation of Classroom-Based Assessment and School-Based Assessment as assessment programs in public schools is to significantly measure students' mastery of the science curriculum which contributes towards the goal of developing well-rounded students. However, School-Based Assessment was repealed in the year 2017 and was replaced with Classroom-Based Assessment in 2019 (Ministry of Education Malaysia, 2018). This has significantly changed the assessment system in place for science as there are a number of differences in terms of policies, methods and content. Thus, the comparison between Classroom-Based Assessment and School-Based Assessment of Science has been tabulated in the following Table 4.

TABLE 4
Comparison between Classroom-Based Assessment and School-Based Assessment

No.	Classroom-Based Assessment	School-Based Assessment
1.	Using DSKP KSSR Science Review 2017	Using DSKP KSSR Science 2011
2.	Implementation guidelines are formulated by BPK, KPM	Implementation guidelines are formulated by LP, KPM
3.	There is no centralized examination system at the school, PPD, JPN or LP level.	There is a centralized examination system.
4.	Only implemented for level 1 primary schools.	Involves level 1 and level 2 primary schools.
5.	Specific implementation for assessment in the classroom only.	The implementation of assessment involves inside and outside the classroom.
6.	Teachers play an important role in planning, formulating, implementing and monitoring student assessments.	Involve various parties in planning, formulating, implementing and monitoring student assessments such as school management, PPD and JPN.
7.	Assessment is determined through performance standards which are interpreted as Mastery Levels 1 to 6.	Assessments are determined through performance standards that are interpreted as Bands 1 to 6.
8.	Assessment is guided by two main aspects of the curriculum, namely thinking skills and 21st Century Skills	Assessment is guided by aspects of thinking skills in the curriculum.
9.	For more students to master science and venture into STEM.	For students to master science and technology.
10.	Assessment is categorized into assessment as learning, assessment for learning and assessment about learning.	In School-Based Assessment, assessment is only categorized as assessment as learning and assessment for learning only.
11.	The content objective of science assessment emphasizes more on inquiry approach, concept of application of scientific knowledge, thinking skills, scientific skills towards problem solving, decision making and producing innovation.	The objective content of science assessment is highly emphasized to stimulate curious students to master science knowledge, thinking skills, scientific skills towards problem solving and decision making only.
12.	Classroom-Based Assessment emphasizes that students can practice and play a role in caring for the environment.	emphasizes on students only being aware of the importance of caring for the environment.
13.	The classroom-Based Assessment data management information system is offline and managed by the subject teachers themselves.	The school-Based Assessment data management information system is centralized online and managed by the school committee and subject teachers
14.	Does not require specific evidence in assessing students because it happens all the time in the classroom.	Each student assessment requires specific evidence and needs to be kept in a specific place.
15.	Classroom-Based Assessment completely replaces grade -based	Student assessment in the form of grades and Bands.

It can be concluded from Table 4 that there are 15 differences between Classroom-Based Assessment and School-Based Assessment and one of the most contrasting differences is the main reference source, curriculum content, drafting of implementation policy of both types of assessments, demography of teachers and students involved, method of conducting assessment, method of assessing students' mastery level, aim of assessment, content standards assessed and data management system of assessment. Therefore, Classroom-Based Assessment used in science assessment is a 21st-century that emphasizes the concept of being student-centered and authentic. The school-Based Assessment implemented has a lot of room for improvement which is seen to rely solely on summative assessment for pupil assessment. Accordingly, this matter can overcome by implementation of Classroom-Based Assessment because it is implemented summative and formative assessment. So, it can measure the ability and capability of students with various assessment activities to assess student achievement in science. Although this Classroom-Based Assessment is still new, this assessment can develop students' skills optimally in scientific skills, manipulative skills, problem-solving skills, analytical skills, and decision-making skills in line with 21st-century skills.

SUGGESTIONS AND CONCLUSION

Today, Classroom-Based Assessment has widely used where centralized and traditional examinations are no longer relevant. The classroom-Based Assessment approach has been emphasized in the education system this time for every student in all subjects, especially science. Various assessment methods are given to science students such as simple projects, online quizzes, experimental recordings as well as teacher observation methods during online learning. So, to respond to the call of the MOE and strengthen the education system to be resistant of future changes and technology, all teachers, especially science teachers must be prepared for any current changes and adapt quickly to ensure that the assessment methods used are always relevant and reliable. Therefore, it is generally found that Classroom-Based Assessment in science subjects can be widely used to determine student achievement in science education at both primary and secondary levels as it can be conducted in a multitude of ways that is not constricted by time and place, reduces the workload of teachers, can be accessed and assessed in a number of situations as well as determining Level of Mastery of students in subjects learnt especially science in a comprehensive manner to ensure that the aspirations of MOE towards students mastery of 21st century skills is achieved.

Based on the analysis done in this study, it can be concluded that Classroom-Based Assessment gives a positive impact on student achievement. Classroom-Based Assessment is found to be appropriate to be used at both secondary and primary level in assessing student achievement. Despite so, studies on the effectiveness of Classroom-Based Assessment are still limited and have not been explored in depth in Malaysia. Thus, the traditional approach needs to be given a fresh overview in adapting Classroom-Based Assessment to ensure the national education system progresses in line with 21st century education. Therefore, it can be concluded that the implementation of Classroom-Based Assessment is impactful in realizing the development of students that are well equipped with 21st century skills through the various assessment activities conducted in the classroom.

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