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SCIENCE TEACHERS' PERSPECTIVE ON THE CRITERIA OF TECHNOLOGY-ENHANCED CLASSROOM-BASED ASSESSMENT (CBA) TOOL

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ABSTRACT

In line with government policy to enforce classroom-based assessment (CBA) for lower primary school, science teachers need to focus more on student's character building through establishing a fun and meaningful teaching and learning culture. Based on the standards-based school curriculum, assessment must be done holistically and authentically as part of the teaching and learning process. However, previous studies have found that teachers do not entirely understand the implementation of CBA in teaching and learning. This problem could arise as teachers find it challenging to construct instruments related to CBA, as they are more familiar with examinations that evaluate student's achievement. Thus, this study explores teachers' perspectives on the best criteria of a technology-enhanced assessment tool consistent with the current CBA practices and student's required skill development in science. Qualitative analysis revealed teachers' evaluation criteria in three categories, i.e., user control, visual and technical usability, and support. The results point to recommendations for future research on evaluating the capabilities of existing mobile apps in classroom-based assessment.

Keywords: *Mobile Apps, Usability Testing, Classroom-Based Assessment (CBA)*

INTRODUCTION

Assessment is a process of identifying, collecting, and analyzing pupils learning to understand their development over time. In line with the Malaysian government policy to eliminate mid-year and end-of-year examination practice for lower primary school pupils and implement classroom-based assessment (CBA), schools are given the responsibility to focus more on student's character building through establishing a fun and meaningful teaching and learning culture. Classroom-based assessment (CBA) is essential for the teacher to identify the strengths and weaknesses of the pupil and continuously improve the student's knowledge and skills as part of the teaching and learning process.

CBA refers to any assessment incorporated in classroom instruction, whether explicit or implicit, instead of large-scale traditional evaluations administered outside the classroom. It emphasizes providing descriptive feedback as evidence of student learning, wherein learners are taught about their strengths and weaknesses and scaffolded to minimize the gap between their present and intended performance

(Yan et al., 2022). In general, perceptions of CBA can be divided into two categories: those limited to teacher-based evaluation and those extending to external non-teacher-based classroom assessments (Dang, 2017). CBA is not a new assessment method in Malaysia, as it was already introduced in 2011. However, since 2019, CBA has been thoroughly reinforced for lower primary school pupils and focuses on student learning.

Despite this fact, previous studies have found that teachers still struggle to comprehend the concept of CBA. For instance, Arsaythamby, Krishnasamy, and Ruzlan Md-Ali (2015) found that our teachers do not entirely understand the implementation of CBA. Science teachers find it challenging to construct instruments related to alternative assessment in various forms as they are more familiar with examinations that test pupil achievement. Furthermore, Tan (2010) mentioned many issues associated with the implementation of CBA in Malaysia, especially teacher-related issues. Previous research found that some teachers still lacked an understanding of the needs and goals of this PBD implementation. According to Muda et al. (2023), some teachers are still unclear about the concept of assessment and the process of implementing assessment due to not having fundamental knowledge and skills about CBA. Teachers' knowledge of CBA is essential as it directly impacts students' learning. A study by Dang (2017) also found that teachers' CBA practises were hampered mainly by big class sizes, insufficient teaching and assessment time, and imprecise marking standards. Previous studies (e.g., Khoo, 2019; Fadzil, 2020; Suprianto, Ahmadi & Suminar, 2019) revealed the benefit of using technology in enhancing the effectiveness of classroom-based assessment in STEM education.

Technology in assessment is gaining popularity in science education. It offers many new opportunities for innovation in educational assessment. As new learning, teaching, and assessment strategies become more widely available, teachers' use of technology to support the delivery of assessments to young learners by providing those teachers with a new application tool becomes increasingly important in education (Bennett et al., 2017). However, Dunphy, Mullane, and Allen (2016) state that technological advances are under-utilized in assessment processes. According to Grive, Padgett, and Moffitt (2016), educators no longer hold negative perceptions about using technology in teaching and learning. Studies show that teachers and pupils benefit when online assessment is implemented appropriately. According to Spector et al. (2016), assessment technology is large and diverse, allowing for collaborative, experiential learning and rapid feedback in teaching and learning.

Technology-enhanced assessment can provide the information teachers need to improve learning through rich assessment tasks and potentially powerful scoring, reporting, and real-time feedback mechanisms. Over the last few years, many recommendations for instructional design employing mobile technologies have been created (Gashoot et al., 2023; Brenneman et al., 2019). For example, the Framework for the Rational Analysis of Mobile Education (FRAME) model, proposed by Koole (2009), tackles three components of mobile learning: the technological qualities of mobile devices, the learner, and the social context. Vavoula and Sharples (2009) developed a three-level paradigm for evaluating mobile learning, with a micro-level for usability, a meso-level for the learning experience, and a macro-level in assessing integration into current educational and corporate contexts. Therefore, the primary purpose of this paper is to explore the criteria of a technology-enhanced assessment tool in the form of a media app consistent with the current CBA practices. This paper addresses the following research question: What are the criteria of a classroom-based assessment (CBA) tool aligned with the curriculum standards for primary schools for lower primary science in Malaysia?

METHODOLOGY

This study employed a qualitative research methodology to understand this particular phenomenon. One of the significant characteristics of qualitative research is the application of a holistic perspective that conserves the complexities of human behavior. The study involves 20 science teachers who teach science in Grade 3. The teachers were purposively selected. The participant's selection was based on typical case sampling simply because the teachers came from government schools, that was not unusual. They reflected the average phenomenon of interest (Merriam, 2019). Before commencing the

study, the researcher seeks ethical clearance where the participants have been assured of their confidentiality and privacy.

The flow of the research is based on the three phases of inquiry. The *planning phase* is where the researchers will analyze the current Grade 3 science syllabus and align it with the classroom-based assessment methods to be used by science teachers. In the *action phase*, the researchers developed a CBA tool in a mobile app to facilitate science teachers in assessing lower primary school students. The developed CBA tool was tested and enhanced during the pilot study. In the *result phase*, data is collected from the science teachers through interviews to explore their experience using the developed mobile app to assess lower primary school students. This paper addresses the result of the action phase, where the teachers were interviewed individually, and their feedback was used to enhance the apps further. The interview protocol has been validated by two experts in the field of qualitative research and technology in education. The questions asked in the interview protocol adapted from Baran et al. (2017) include:

1. What is your general view of this application?
2. Is this app easy to use?
3. Is it user-friendly?
4. Can it help you be more effective in classroom-based assessment in STEM?
5. Can it save you time when you use it?
6. Provide suggestions for improvement so that this application can help teachers in classroom-based assessment practices.
7. What would you suggest to improve this app?

Collected data is analyzed comparatively using the constant comparative data analysis technique to understand this central phenomenon. Further analysis involves the process of coding, categorizing, and developing themes from information that emerges from the collected data.

Jumlearning Application

Jumlearning is a mobile application developed by the researchers' team. Figure 1 shows the interface of the developed Jumlearning application. Teachers need to sign up for the application using their Google email. The assessment in Jumlearning apps involves quizzes, mini projects, story-telling, role-play, and games, which aligns with the Ministry of Education's (2019) classroom-based assessment strategies for primary school. The teacher can click the type of assessment they want and set up a suitable assessment rubric for the science topic.

Figure 1. *The interface of the Jumlearning app*

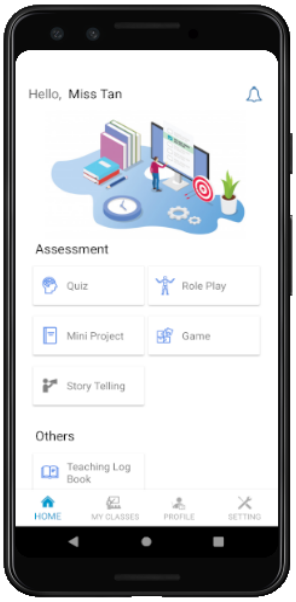

Figure 2. *The assessment in Jumlearning apps involves quizzes, mini projects, storytelling, role play, and games.*

In this app, a few examples of activities for each type of assessment have been given to teachers, who can also upload their teaching and learning materials (Figure 2). For instance, in the mini-project module, the teacher can conduct a project on density and build a mini boat with the primary school students. During the activity, the teacher will use the app and assess the students individually or as a group. The application's criteria for student assessment can be searched by selecting the subject, assessment type, or topic.

Student achievement in the activities is given according to the performance standard, i.e., from Band 1 to Band 6 (Figure 3). The performance standard is a teacher's reference scale for determining student achievement in mastering the learning standard and content in science. The performance standard in science contains six levels of mastery, which are arranged hierarchically. Level of mastery one or Band 1 shows the lowest achievement of students, and the highest achievement is mastery level six or Band 6 (Figure 4). Student achievement is determined by teacher's professional judgment (Ministry of Education, 2019). Professional judgment is a form of decision that the teachers make ethically related to the student learning by using knowledge, skills, and experience to develop student mastery in education.

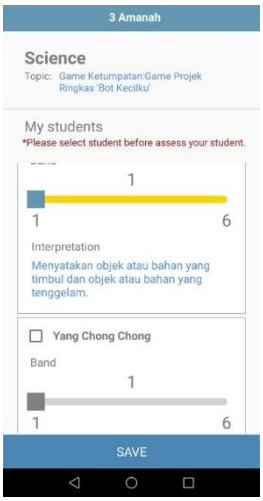

Figure 3. *Assessing student from Band 1-6*

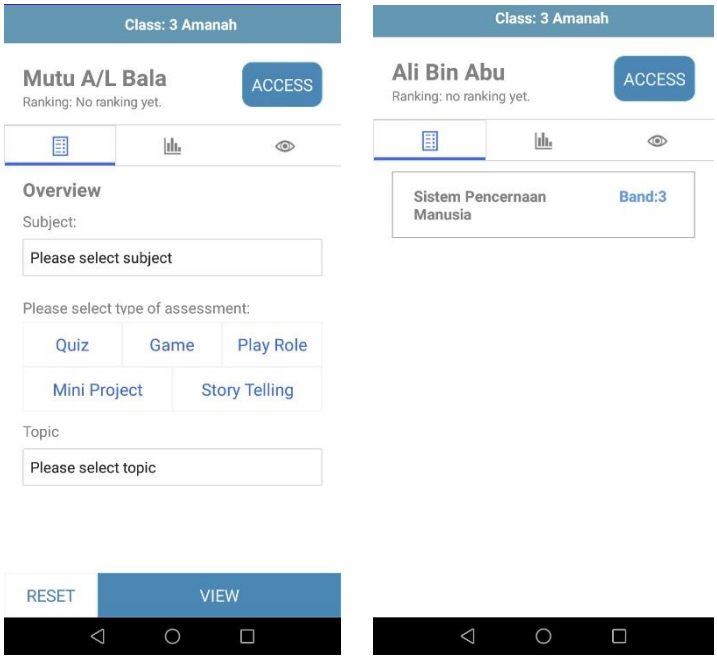

Figure 4. *Student achievement based on performance standard*

FINDINGS AND DISCUSSION

Mobile apps revolutionize assessment by providing authentic assessment experiences to teachers in this study. Qualitative analysis revealed science teachers' criteria for technology-enhanced classroom-based assessment (CBA) tools in three categories, i.e., user control, visual and technical usability, and support. The following table (Table 1) explains the definition of the emerging themes for this study.

Table 1
Definition for the emerging themes

Category	Definition
User control	Managing interaction between teachers and the application involves allowing teachers to customize their experience and maintain a sense of autonomy.
Visual and Technical usability	Visual usability involves the visual elements of a web-based application to create a visually pleasing and intuitive user interface that enhances the user's overall experience. Technical usability focuses on the performance and functionality of the web-based application.
Support	Assisting teachers on how to utilize control assessment features effectively.

User Control

User control in the findings refers to how teachers can manage their interactions with the application. It involves providing the teacher with the options to customize their experience and maintain a sense of autonomy. For example, in this study, the teacher mentioned that they need alternatives to assess the students individually or in groups. Teacher 4 said, "*it is essential for the app to allow the teacher to*

assess individual students and multiple students together, especially if the assessment involves group activity".

Teachers also indicated they should be allowed to configure settings and preferences according to their needs. This could include customization of appearance, layout, and functional choices. The teacher should also be able to add students' information about their progress in each module in the app. In assessing the students, Teacher 12 added that "*using a drop-down or sliding button also helps us assess the students efficiently during the teaching and learning activities"* (as shown in Figure 3).

During the interview, Teacher 3 emphasized how the classroom-based assessment tool or the apps would be helpful in the classroom for tracking student progress in learning science. Teacher 12 mentioned that *the app's activities align with the objectives in the current science syllabus* (T12, ln. 13). The ability to assess learning through various assessments was a crucial feature of mobile applications (Baran et al., 2017).

Tracking and reporting learner progress in classroom-based assessment were essential to mobile apps. Teacher 1 also mentioned that it would be helpful if the applications enabled them to share the data with other teachers by giving users control over who can access their data and allowing teachers to export their assessment data. Teacher 15 highlighted that the student's report in the application should also be shared with other teachers to inform them about student progress and so that they can also give constructive feedback related to students' performance.

According to the findings of this study, primary school teachers had generally positive views towards the CBA application. This aligns with research by Yan et al. (2022), who reported that teachers regularly attempt to implement CBA practices in their classrooms to assist students' learning. Their attitudes towards CBA appeared to influence their assessment practices strongly.

Visual and Technical Usability

Visual and technical usability are two essential aspects of web-based applications that contribute to the overall user experience. Visual usability in the findings deals with the visual elements of a web-based application. It aims to create a visually pleasing and intuitive user interface that enhances the user's overall experience, including layout, organization, and use of relevant and high-quality images, icons, and graphics. The teachers in this study particularly valued simple interfaces with minimal visuals so they would not get distracted from their primary task of assessing the students during activities. Using readable fonts and appropriate font sizes is crucial in developing apps (Baran et al., 2017). Consistency in font choices and text formatting enhances readability, which is essential for teachers in classroom-based assessments.

When the teachers in this study used the apps, they concentrated on efficiencies, such as having clear instructions or visuals for tools, a simple interface, the option to record progress, and options to choose the language, either in Malay or English. Teacher 8 also mentioned that he prefers if the apps "*enable teachers to create profiles that store their preferences and allow for a personalized experience each time the teacher interacts with the assessment application".*

On the other hand, technical usability focuses on the performance and functionality of the application. It ensures that the application functions correctly and efficiently. Technical usability criteria refer to the practicality of a mobile application's technical features and focus on the interface and user–mobile app interaction. While evaluating technical usability, the teachers noted that the application functions should be visible to the users, such that clear directions and feedback were provided when interacting with the apps. The application should also support multiple devices, such as tablets, smartphones, laptops, and computers, as suggested by Teacher 1.

Another critical aspect of technical usability is the page loading speed. Slow-loading pages can frustrate teachers while assessing students, especially when it involves larger classrooms with more students.

Visual and technical usability is crucial to creating a web-based application with a positive user experience.

Teachers must know digital tools and the ability to utilize them to benefit from the potential benefits of digitalization and be mindful of the dependencies it creates. Furthermore, they must be able to determine when digital tools provide a competitive advantage and when traditional options (such as print-based materials) may better fit their pupils (Paleczek, et al., 2023), especially regarding classroom-based assessment.

Support

Support emerged as another important criterion of a classroom-based assessment (CBA) tool. Most teachers explained that they needed the application to provide a tutorial, a search option, and an easily accessible help menu. However, some teachers, such as Teachers 3 and 6, mentioned that the *Jumlearning* app is amicable to use, "*the information is visibly presented*" and "*it can be used with limited training*".

The teacher also mentions that it is good to provide tutorials and guides to help them understand the features and functionalities of the application. Previous findings also stress the importance of educating users on effectively utilizing an application's control features. The teachers also requested more activities in the application, with suitable ways to assess each activity. Teachers in this study feel that more initiatives need to be taken so that teachers are more confident of their level of readiness in conducting CBA.

The application can also be improved by adding feedback mechanisms, such as feedback forms or surveys to gather user opinions about the application. This information can be used to make further improvements and address concerns related to Jumlearning apps. The teacher also requested personal feedback to be given to the students, other than information regarding their band. Giving feedback is an essential skill and significantly influences the quality of the learning process (Ahea et al., 2016).

CONCLUSION

Assessment is a barometer for the teacher to measure student development over time. In order to monitor the student's growth in STEM education, a holistic assessment approach must be created. Previous studies have found that teachers lack knowledge and understanding of the principles of CBA. Teachers lacked preparation in conducting the new form of assessment for learning due to the lack of opportunities to learn the appropriate techniques and proper assessment practices. This issue has become more challenging since teachers could not conduct CBA more creatively due to time constraints and inadequate resources.

There were also huge gaps between teachers on their readiness to implement assessment for learning, such as determining clear standards of achievement and deciding on standards that adhere to the curriculum for the pupils. Moreover, teachers had to provide evidence of learning, assess students' involvement, and keep systematic records throughout the school year. We must keep in mind that teachers' knowledge of CBA will directly impact students' learning and outcomes in science. Most of the assessments in schools are paper-based assessments. Analysis of the results is time-consuming, and feedback cannot be obtained instantaneously, especially when dealing with many students, such as those at the primary school level. Thus, media application development has been seen as an effective tool to assist teachers in "what" and "how" they teach and assess scientific knowledge and skills.

Qualitative analysis in this study revealed science teachers' criteria for technology-enhanced classroom-based assessment (CBA) tools in three categories, i.e., user control, visual and technical usability, and support. By focusing on these aspects, developers and designers can create technology-based applications that empower teachers and provide them with a positive and personalized experience. This study addresses the recent government policy to fully enforce classroom-based assessment (CBA) for lower primary schools. More research on developing a tool for classroom-based evaluation is needed to

identify best practices for using such a tool for effective and practical assessment in science. Future studies should examine student learning outcomes that lead to effective classroom-based assessment practice.

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