

An Assessment of the Effectiveness of the Implementation of the Mathematics ‘Assessment for, as and of Learning’ Strategy in a Primary School in Dubai

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Abstract

The effective implementation of classroom assessment is central to a successful teaching and learning cycle. The present study aims to assess the effectiveness of the implementation of the mathematics ‘Assessment for, as and of Learning’ strategy in a primary school in Dubai. Participants in this study were six third grade students grouped into three groups (low, middle, and high achievers) together with the primary Math coordinator and a classroom teacher. The study employed four research methods: classroom observations, analysis of some students’ assessment work, semi-structure interview with the coordinator and teacher as well as students focus group discussion. The findings revealed that the ‘Assessment for, as and of Learning’ strategy is mostly effectively implemented in mathematics providing an efficient data collection resource that measures students’ understanding and informs future teaching instructions. Still, some challenges arise from the need to differentiate assessments, features of online testing, and the inconsistent feedback. Discussions were then made on these issues in the classroom and the expected effect on students’ learning. Therefore, implementing ‘assessment for, as and of learning’ strategy in mathematics has an operative effect on students’ learning progress but should take into consideration the implied challenges.

Keywords: assessment, learning, formative, summative, mathematics

1. Introduction

Assessment application and purposes have been enhanced and developed during the last decade because of the growing research interest in the evolution of various assessment forms (Brown 2022). Assessment is the process of collecting and analysing information about students' knowledge, skills, and abilities to evaluate their learning progress, inform instructional decisions, and provide feedback for improvement (Guskey & Bailey 2020). Effective assessment is vital for teaching and learning as it promotes and improves the quality of teaching and learning for students. Gardiner (2019) elucidated that assessments have greater impact by promoting lifelong learning goals and significantly boosting students' achievement.

According to Yambi (2018), assessment is a process that integrates four essential components. First, monitoring improvement within a period to check a student comprehension for a determined skill or concept. Second, motivating pupils to learn knowing their current state and working for next step. Third, evaluating the applied teaching pedagogies for enhancement purposes, and fourth, differentiating the students in groups based on their capabilities and learning styles. To implement these components, three main types of assessments can be conducted: Assessment *for* Learning (AfL), Assessment *as* Learning (AaL), and Assessment *of* Learning (AoL).

The United Arab Emirates (UAE) educational vision is to ensure quality and innovative education for every student. This was illustrated in the National Agenda Indicators of the Ministry of Education (MOE) highlighting the necessary improvement across national

and international tests (MOE, 2022). Hence, schools designed their own assessment policies that define assessment approaches according to the UAE educational vision, subjects' nature, and targeted outcomes. A case example is the assessment policy of a private British curriculum school in Dubai which is used as the reference point for this research paper. The document asserts that implementing 'Assessment For, As and Of Learning' strategy helps students monitor their learning process, guides teachers to tailor their planning and keeps all the stakeholders informed to drive learning forward.

The immense development in the information and communication technology (ICT) during the last era led to an evident change in both teaching and learning processes. This change was inevitable because of the Covid-19 pandemic disruption. Technology then proved to have convenient and valuable alternatives that promoted the teaching and learning processes. Various online assessment tools demonstrated flexibility, accessibility, automated scoring, and reduced paper usage (Moursund 2016). Additionally, as an experienced math teacher, it is observed that students have different backgrounds, cultures, raising environment, preferences, and other personal characteristics. These characteristics absolutely require varying assessment approaches to help students express themselves freely and confidently. Such reasons impulse the need to evaluate the school's assessment policy especially given that the next review date for the policy would be at the end of this academic year (2023).

Thus, this paper aims to assess the effectiveness of the implementation of the ‘Assessment For, As and Of Learning’ strategy in Mathematics in a British curriculum primary school in Dubai. Accordingly, the following objectives are formulated:

- Understand the ‘Assessment For, As and Of Learning’ strategy in mathematics.
- Determine the prospects and challenges for the implementation of the assessment strategy.
- Recommend for better future practices.

2. Literature Review

Assessments profoundly are about making judgements on students’ learning with evidence. These judgements serve different purposes, use different techniques, and play a major role in the teaching and learning processes. The literature review below aims to differentiate between three main assessment forms ‘For, As and Of’ learning as well as highlight the difference in implementing them as paper based or online.

2.1 Assessment for Learning

It is an approach to assessment that emphasizes the use of assessment as a tool for learning, rather than a means of measuring performance. It involves providing students with feedback on their progress to guide further learning. William (2021) pointed out; “Assessment should not be separate from teaching. It should be an integral part of teaching and learning, providing students with feedback on their progress and helping them to improve their learning.” In this way, assessment for learning mainly refers to

formative assessment or ongoing assessment carried out in the course of learning and teaching. Formative assessments take place when teachers and students are actively engaged in a continuous learning dialogue that subrogates knowledge linear transfer into collaborated deep learning (Amua-Sekyi, 2016). This dialogue helps teachers in identifying students learning gaps to take helpful remedial actions.

Formative assessment is applied on daily basis to frequently check attainment and progress. Through formative assessment all learning parties can recognize strengths and weaknesses of used teaching strategies, curriculum, and school policies (Yambi 2018). Formative assessments approaches encompass practices for collecting and interpreting students oral or written work including oral questioning, homework, exit cards, peer and self-assessment, and presentations accompanied with constructive feedback.

The formative assessment process can be broken into four main steps (UNICEF 2022):

1. Communicate and explain the success criteria.
2. Identify what students have understood.
3. Provide appropriate feedback stating what went well and what still need improvement.
4. Plan and discuss the learner's next steps.

Cambridge Assessment International Education (2023) used the term Metacognition to describe 'thinking about thinking'. Thus, formative assessment interferes in developing metacognitive skills because it allows students to reflect on their learning, realize how do

they learn the best and be able to reinterpret previous knowledge or experience.

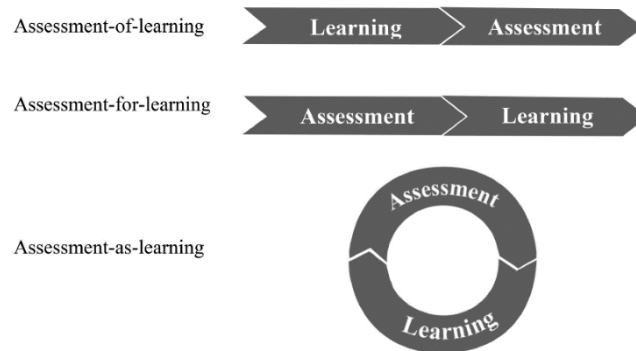
2.2 Assessment as Learning

It is a student-centred approach that encourages students to take an active role in learning.

It is intended to reinforce and extend the AfL role. It comprises observation, interpretation, and judgment of students' performance according to an explicit criterion, with self-assessment and resulting feedback. "It serves to confirm student achievement and provide feedback to the student for the improvement of learning and to the instructor for the improvement of teaching" (Mentkowski 2006, p. 48 as cited in Yan & Boud 2021).

AaL develops and supports metacognition for students. It reveals the student as a critical connector between assessment and learning. Figure 1 shows that through AaL students make sense of information then combine and assess with prior knowledge to establish new learning. This cycle emphasizes the metacognition and self-regulation skills inherited in AaL. Moreover, it allows students to monitor their own learning, ask questions and use the given feedback to adjust and adapt what they learn. The teacher's role in AaL is to help students become familiar with reflection, aware of self and peer assessment techniques and develop critical analysis skills (Yan & Boud 2021).

Figure 1: Relationship between learning and assessment in assessment of/for/as (Yan & Boud 2021, p.7)



Hong Kong Curriculum Development Council (2017) argued that schools should integrate AaL in the school educational systems because it sets students' roles and responsibilities as per their progress in learning and assessment. AaL engenders opportunities for students to seek, interrelate and use evidence. In AaL completing the task is necessary but not the major learning condition. Yet, the long-term learning target is to develop student's evaluative judgements and contribute to sustainable assessments. Meaningful tools for applying AaL include reflective writing, learning checklists and rubrics for tasks and activities.

2.3 Assessment of Learning

AoL refers to the process of measuring a student's knowledge and understanding of a subject or skill. It is often used to summarize and determine whether a student has achieved the learning objectives of a course or program at a particular time for

accountability and judgements (Gardiner 2019). National Qualifications Framework (NQF 2017) define AoL as summative assessment conducted at the end of each learning chapter, the whole learning programme, or any point in the program, to evaluate learning against the subject's standards and learning outcomes.

AoL gauges how a class respond to a topic assessment rather than focusing on one student. The aggregated data is usually shared among teachers, head of departments, and parents to judge the practicality and usefulness of the material taught, curriculum, and teaching instructions used to meet the set standards. AoL includes end-of-chapter quizzes, midterm exams, final exams, capstone projects, essays or research papers and standardized tests. Standardized tests play a pivotal role in ensuring the school alignment with local standards and the equity of students regardless of their background, race or socio-economic characteristics (States, Detrich & Keyworth 2018).

Summative assessments are usually accompanied by rubrics. Rubrics refer to set of objectives, learning expectations or principal standards. They can be explained to students ahead of the required task so that students can know what is expected, their success criteria and working plan. Rubrics are considered helpful because they set clear aims, define needed strategies, and assure objectivity in grading (States, Detrich & Keyworth 2018).

Summative assessments are valuable for most of the students because they have long-term consequences on their future. For instance, summative assessment scores might be used as the basis to support scholarship or studentship for further studies, earn a high

school certificate, or gain entry to college. Moreover, Moss (2013) argues that analysis of summative assessment results may elevate insights for teaching current students only, but also can be a helpful guide for educators to know how, when, and where to redesign instructional practices to enhance next year's students' scores.

2.4 Online Tests OT

The use of computers and/or tablets for assessment has been of great interest for educational researchers during 21st century especially with the spread of Covid-19 virus. Online testing tools have proved their role in engaging younger ages and relieving the stress of the assessment concept (Shute & Rahimi, 2017). Nonetheless, the research found that there are some obstacles hindering the effective implementation of OT. Two main obstacles are: device user-friendliness and assessment reading-demand (Dadey, Lyons, & DePascale, 2018).

Hamhuis et al. (2020) suggested that when students are not familiar with the device used for testing, their performance in PBT would be better than OT. Knowing the device features, having regular access and being familiar with the properties are significant factors that ease students work and enhance their confidence during digital testing (Hamhuis, Glas & Meelissen 2020). An example of a complicated device feature might be the virtual keyboard that is difficult to use especially at lower grade levels and can result in many typing errors (Ling 2016). Additionally, using devices for tests was accompanied by some physical discomfort aspects such as neck, shoulder, and back pain.

Younger students also reported eyes and fingers rattle after using the device for long assessments.

Reading demand is another factor influencing the OT effectiveness. For example, the results of Trends in International Mathematics and Science Study (TIMSS) 2011 PBT in Mathematics showed wide gap between low reading demand questions and high reading demand questions (Mullis, Martin, and Foy 2013 as cited in Hamhuis, Glas & Meelissen 2020). Nardi & Ranieri (2018) warned that this effect is of higher risk for OT because of the visual fatigue where students are reading from a screen and might need to scroll which disperses the memory work especially among primary school students.

In conclusion, ‘Assessment For, As and Of’ learning strategy in the form of paper-based tests (PBT) or OT need a thorough analysis to determine how and when to integrate these assessments to ensure students solid understanding of the material taught as well as appropriate teaching pedagogies applied.

3. Method

3.1 Participants

The participants in this research were a primary level Math coordinator, a grade three Math teacher and her six students in a private British curriculum school in Dubai. The participants were selected using the purposive sampling technique and can be clustered in two groups as follows:

- Teaching group: The Math coordinator and Math teacher were both having an experience between five to ten years. The Math teacher was the mainstream

classroom teacher who collaborates with the coordinator in designing the mathematics assessments for grade three.

- Learning group: Six third-grade students of mixed gender (three boys and three girls) were chosen based on their academic achievement such as: two high achievers, two middle achievers and two low achievers.

The involved school received a consent form stating the research targets, methods, procedure, besides ethical and confidential concerns. Then, the participating coordinator and teacher individually accepted a consent elucidating same elements as the school consent, the observation guidelines, the semi-structure interview targets and timing of each. Afterward, the school administration contacted the students' parents to get the agreement on observing and questioning their kids on the research points. Then the classroom teacher informed students about the research main aim and expected visits. Furthermore, the participants were assured that their names will be kept anonymous because the participation is a voluntary work that would not affect or harm their employment status or personal life at any level.

3.2 Research Design

The research adopted a qualitative research design with an interpretivism paradigm since the study's objectives demand close and thorough observation, profound and in-depth understanding of the participants' responses and precise analysis of the results.

Qualitative research can be defined as an iterative work through which data is compiled, proofs are gathered, and interrelations are established (Aspers & Corte, 2021). Cropley (2023) described qualitative research as the process of “enlarging knowledge and understanding”. His description is based on the fundamental belief that “reality” is subjective and the outcomes vary with respect to the situation, setting and participants personal characteristics.

To generate data to achieve the aim of this research, four methods have been used/integrated: classroom observations, analysis of assessment documents, teacher and coordinator semi-structure interview and students focus groups. Precisely the research utilized ethnography approaches. Ethnography research is the systematic study of people and cultures where the researcher himself is engrossed in the classroom being assessed (Bhandari 2020).

3.3 Procedure

The fieldwork in the research was carried through several classroom observations for a grade three section in the second term of the academic year 2022 – 2023. The researcher acted as the observer, interviewer, and data scientist. During classroom observations, the researcher relied on a set of observation scheme to document the classroom interaction during the three forms of learning assessments (for, as and of). An observation scheme can capture and characterize classroom discussion and collaboration because the teacher’s interaction with students, subject material and teaching program is always dynamic

(Vidhiasi 2018). The observation scheme used is a semi-structured observation form. It was adopted from the Manchester Metropolitan University (2023) observation template forms (Appendix 1). The scheme criteria focus on four main areas that serve the research objectives as follows:

- Observation target(s)
- Observation notes and points to discuss
- Good practices
- Recommendations or discussion ideas

Later, semi-structured interviews were conducted with the math coordinator and the classroom teacher. The interview main focus was to recognize the opportunities and challenges that accompany the ‘Assessment For, As and Of’ learning strategy and how to use the assessment results to inform instruction and improve learning. A semi-structured interview is defined as a dialogue between the researcher and the participants, managed by a flexible interview protocol entailing several follow-up questions, discussions, and probes (DeJonckheere & Vaughn 2019). This method encourages two-way communication, ensures open-ended data, and helps explore participants’ thoughts regarding the discussed topic. The interview was scheduled during the teacher’s free period upon her and the math coordinator agreement.

Moreover, a focus group discussion was escorted with the students. The discussion key

points were to determine the students' view regarding the assessment, their preferences and how it is impacting their learning journey. The discussion was face-to-face for around 20 minutes after school timing. During the meeting, the researcher acted as a facilitator leading the discussion, asking questions, inquiring about observed aspects, clarifying if needed, and directing the debate towards the research main aims (Evaluation Research Team 2018). Besides, to ensure authentic data an impartial note taker was writing the main points of the attendants' responses along with an audio recording that produces a transcript.

Finally, samples of students work during assessments were shared with the researcher for analysis and comparison purposes. The documents include the three forms of assessments 'for, as and of' learning either as PBT or OT. The results are interpreted and compared to the school's assessment policy objectives and approaches.

3.4 Findings

The classroom observation provided insights on the students' interaction with the assessment. Students were performing formative assessments on Nearpod or papers mainly with same enthusiasm. Throughout their daily tasks, students worked through multiple AaL forms. The assessments content required critical thinking and problem-solving skills. They were rigorous and let students deal with challenges productively. The teacher in turn, was positively providing reinforcement but precise feedback was rarely given to the students.

It was noticed that the teacher routinely provides summative assessment (AoL) after the end of each chapter or lesson. The summative assessment was composed of two parts: PBT and OT. Table 1 shows that students' grades in PBT were mostly higher than OT within the same content (for example: 9>7). Students of all groups took enough time to finish the PBT whilst low and middle achievers rush to finish the OT ahead of the set time. A detailed and clear feedback was usually written on summative assessments.

Table 1: Students scores in end of chapter PBT and OT

	PBT score (/10)	OT score (/10)
Student 1	9	7
Student 2	7	6
Student 3	5	3
Student 4	10	8
Student 5	8	7
Student 6	4	4

Further, all levelled groups showed high engagement when being assessed through interactive games that were clearly based on the lessons outcomes; such as Kahoot, Time

to Climb and others. Students clearly expressed that they “had fun”. Expressions like “please repeat these games again”, “I really enjoyed the math session today” are proofs that Math OT can work in specific contexts. However, two boys were observed to navigate through tabs and applications, try the available tools, and check the time instead of well-focusing and solving their assessment.

The coordinator and teacher semi-structure interview elucidated that the three forms of assessment work cooperatively to ensure students successful learning. The teacher explained that the AfL results at the beginning of the period are used to group the students to work on differentiated tasks. The closure AfL is to help the teacher plan and set the rigor for next period. The AaL guides the teacher to reteach, enrich and scaffold accordingly. Then the AoL assess students’ achievement in reference to the learning standards to inform remediation required or set next outcomes.

The students focus group discussion shared a major idea which is, the fear of written graded tests and the pleasure of being assessed in games or through daily activities. This view illustrated the positive nature of the assessment policy and its implementation.

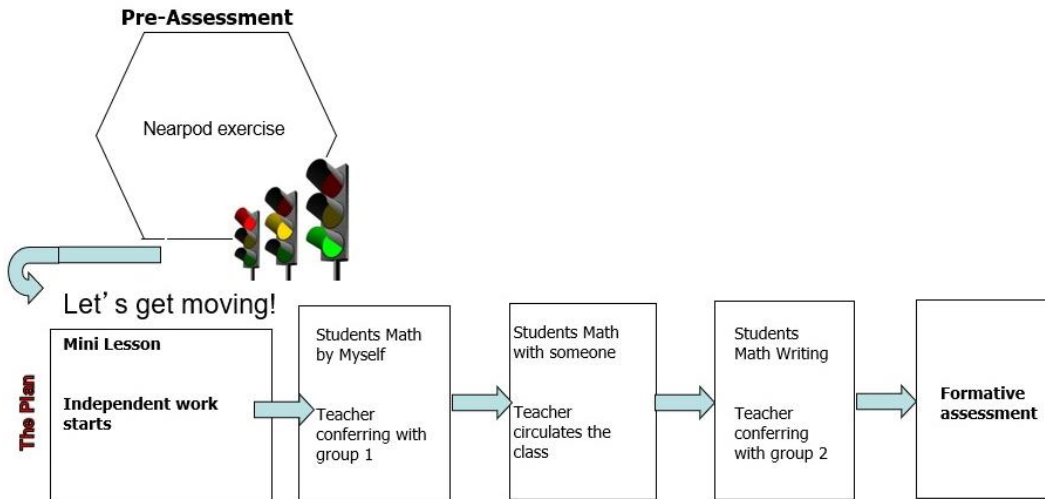
When asked about the teacher’s feedback, students seemed not to be fully aware of the feedback, application and importance. This was so because the assessment approach was fully integrated as part of the learning process. Although, the students explained that the teacher always reinforces them using phrases such as “well done”, “superhero” or

drawing a happy face. The participants also stated that receive personalized written feedback that shows their current state, target, and the way to reach there only in AoL.

3.5 Discussion

The analysis and comparison of the assessment policy objectives with respect to the research results proves that the strategy of ‘Assessment For, As and Of’ learning is being implemented using different forms as advised in the policy. Figure 2 reveals that generally, the lesson starts with AfL in the form of a pre-assessment word problem in Nearpod. This is followed by the teacher’s mini-lesson and differentiated tasks through which AfL and AaL collaborate in the form of conferring with the teacher, self and pair assessments, success criteria, learning checklist and concept maps. The lesson ends with AfL exercise in the form of exit card. Setting an assessment routine helps students to settle and get ready psychologically and mentally.

Figure 2: Lesson Flow



The finding also shows that students work on differentiated tasks, which means it is axiomatic to apply differentiation in assessments too. However, all students do the same AfL and AoL which can cause low achievers to feel that they are always behind their classmates. Differentiated assessment is an educational approach through which teachers adopt variable techniques to provide flexibility in acquiring knowledge, developing skills and the assessment items requested for students (Kaur, Mohammad & Awang-Hashim 2018). To differentiate an assessment tailored to students' educational needs, some elements are to be addressed such as: when, what, how, and why. The classroom teacher can use the data collected from AfL and her observation to decide on the required amendments.

The superiority of PBT scores on OT could be attributed to the assessment design (Dadey et al. 2018). In PBT students are used to show their strategies and work out the required calculations under the question itself or in the paper margin. Conversely, in OT, students are supposed to solve maths problems on their notebooks or scratch paper. Indeed, high achieving students mainly solve math problems using this way, while middle and low achievers adhere to performing detailed calculations on papers which resulted in more calculation errors (Hamhuis, Glas & Meelissen 2020). Students work seriously with PBT often demonstrate strategical thinking (Ling 2016). Simultaneously, the investigation of the eTIMSS 2019 Equivalence Study within Twenty-five participated countries showed that except for the science scores of a country, the average scores per country were lower in OT than PBT (Fishbein et al. 2018).

OT has positive and negative impacts on students' engagement. Students enjoy using a digital device in testing as it is considered a modern trend (Jerrim 2016). Fishbein et al (2018) advocated OT approach because of the devices' facilities such as the interactive simulations, recorded presentations and touching screens easiness particularly when addressed to younger age groups. At the same time, OT can cause various connection issues that results in hindering students' submission, varying the students starting time and causing interruptions. OT can be an engaging and saving-time source for teachers in the way of creating attractive tests, auto-correction, as well as easy and structured data collection. Yet the nature of the lesson and the period length play essential role in

determining the assessment form to employ. To demonstrate, when the lesson focus is a multi-step problem solving it is advised to be assessed as PBT tests. While when the lesson focus is modelling it can be assessed through motivating interactive tools.

The policy's rationale was to improve the quality of students learning through providing feedback that is clear, informative, constructive, timely and relevant to students needs.

Despite personalized and helpful feedback; these were not consistent among the three assessment forms. Kerr (2017) insisted on providing feedback, justifying that, feedback helps students to close their learning gaps by handing them opportunities to identify their strengths and weaknesses, ask questions, explain their answers and contribute in planning their success.

To sum up, the 'Assessment For, As and Of' learning is a successful tool for evaluating students' progress in achieving a learning target and setting the next step based on the acquired knowledge. Though many challenges are discovered like the lack of differentiation in AfL and AoL, online device learning characteristics and engagement, and the irregularity in providing meaningful feedback.

4. Conclusion and Recommendations

The research main target was to assess the effectiveness of the implementation of 'Assessment For, As and Of' learning strategy in Mathematics at primary level. This assessment strategy is based on integrating different forms of assessment at specific learning periods to assess students learning skills. The implementation strategy proved its

effectiveness through providing quality data on students' learning progress and instructional decisions as well as promoting students' divergent and creative thinking. On the other hand, the implementation showed challenges in terms of undifferentiated assessments, OT engagement problems, and the inconsistent feedback.

The overall results seem to agree with Hamhuis et al. (2020) who concluded that students perform similarly in different assessment forms either PBT or OT, but the difference is in differentiation of the assessment. Likewise, ICAPE (2022) found that 'Assessment For, As and Of' learning strategy in primary schools particularly is an effective tool but needs to be improved in means of differentiation. The paper addressed the research main targets; however, some limitations are to be considered for future improvements such as the convenience sample size, the sole subject studied, the single grade level as it might be different with upper or lower graders and within a different curriculum.

Accordingly, some recommendations to inform practitioners and policy makers are as follows:

- First, the major recommendation is to differentiate assessments evidently especially AoL as it is based on the students' level of knowledge acquisition in certain areas. Pupils are diverse in their thinking abilities and prior knowledge which affect the pace at which they comprehend new concepts and demonstrate learning. Hence, employing a variety of assessments that are parallel to students' level and learning style is central to effective

assessment (Kaur, Mohammad &Awang-Hashim 2018).

- Second, a mix of PBT and OT can be an optimal engaging assessment technique but should be controlled. Wise (2019) explicated that in a computer assisted testing environment students' efforts can be monitored according to their responding speed and guided access features can be implemented. Additionally, even though PBT are still a rich resource to assess students' knowledge, the world of facilities ICT skills provide, and the growing technology impose online interference in teaching and learning process.
- Third, the feedback should be consistent among different assessment forms. Students should be aware of the assessment role and feedback effect on their progress. They can be motivated when understanding their strengths within the current time and what are they required to achieve next (Adarkwah 2021). Students at younger ages, principally, requires the teacher's follow up to confirm their comprehension of the feedback and their pursuance.
- Fourth, for validity and generalization reasons it is advised to increase the number of participants, vary the studied subject and grade levels. Through this way the concluded prospects and challenges can be verified, or even new ones are identified.

To conclude, the paper has highlighted the opportunities and challenges of implementing 'Assessment For, As and Of' learning strategy in mathematics. Yet, based on the study limitations in size, examined subject, and studied grade levels, future research about 'Assessment For, As and Of' learning strategy is required. ICAPE (2022) confirmed this

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orientation by expounding that to design an ideal assessment system, schools should base assessment, teaching pedagogies and curriculum on relevant and vigorous research.

References

Adarkwah, M. (2021). The power of assessment feedback in teaching and learning: a narrative review and synthesis of the literature. *SN Social Sciences* [online]. Vol.1(3). [Accessed 14 March 2023]. Available at:

<https://doi.org/10.1007/s43545-021-00086-w>.

Amua-Sekyi, E. T. (2016). Assessment, student learning and classroom practice: a review. *Journal of Education and Practice* [online]. Vol.7(21). [Accessed 28 February 2023]. Available at: <https://files.eric.ed.gov/fulltext/EJ1109385.pdf>.

Aspers, P. & Corte, U. (2021). What is qualitative in qualitative research. *Qualitative Sociology* [online]. Vol. 42(2). [Accessed 11 March 2023]. Available at:

https://www.researchgate.net/publication/355727908_What_is_Qualitative_in_Research#fullTextFileContent.

Brown, G. T. L. (2022). The past, present and future of educational assessment: a transdisciplinary perspective. *Frontiers in Education* [online]. Vol.7(1). [Accessed 16 March 2023]. Available at:

<https://www.frontiersin.org/articles/10.3389/feduc.2022.1060633/full>.

Cambridge Assessment International Education. (2023). *Getting started with assessment for learning* [online]. [Accessed 1 March 2023]. Available at:

<https://www.cambridge-community.org.uk/professional-development/gswafl/index.html#group-Theory-and-benefits-flUQItiN46>.

Cropley, A. (2023). *Qualitative research methods: a practice-oriented introduction*

[online]. [Accessed 14 March 2023]. Available at:

https://www.researchgate.net/publication/285471178_Qualitative_Research_Methods_A_Practice-Oriented_Introduction#fullTextFileContent.

Dadey, N., Lyons, S. & DePascale, C. (2018). The comparability of scores from different digital devices: a literature review and synthesis with recommendations for practice. *Applied Measurement in Education* [online]. Vol.31(1). [Accessed 6 March 2023]. Available at: <https://doi.org/10.1080/08957347.2017.1391262>.

DeJonckheere, M. & Vaughn, L. M. (2019). Semistructured interviewing in primary care research: a balance of relationship and rigour. *Fam Med Community Health* [online]. Vol.7(2). [Accessed 15 March 2023]. Available at:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6910737/>.

Evaluation Research Team (ERT). (2018). *Data collection methods for program evaluation: focus groups* [online]. [Accessed 14 March 2023]. Available at:

<https://www.cdc.gov/healthyouth/evaluation/pdf/brief13.pdf>.

Fishbein, B., Martin, M. O., Mullis, I. V. S. & Foy, P. (2018). The TIMSS 2019 item equivalence study: examining mode effects for computer-based assessment and implications for measuring trends. *Largescale Assessments in Education* [online].

Vol.6(11). [Accessed 14 March 2023]. Available at:

<https://doi.org/10.1186/s40536-018-0064-z>.

Gradiner, J. B. (2019). *Assessment for learning in the primary classroom: a report based on 'Episodes of Interaction' Focussing on Formative Assessment and Effective Pedagogy in Primary Science*. [online]. [Accessed 22 February 2023]. Available at: [10.13140/RG.2.2.11793.07521/1](https://doi.org/10.13140/RG.2.2.11793.07521/1).

Guskey, T. R., Townsley, M. & Buckmiller, T. M. (2020). The impact of standards-based learning: tracking high school students' transition to the university. *Sage Journals* [online]. Vol. 104(4). [Accessed 26 February 2023]. Available at: <https://doi.org/10.1177/0192636520975862>.

Hamhuis, E., Glas, C. & Meelissen, M. (2020). Tablet assessment in primary education: are there performance differences between TIMSS' paper-and-pencil test and tablet test among Dutch grade-four students? *British Journal of Educational Technology* [online]. vol. 51(6). [Accessed 22 February 2023]. Available at: <https://doi.org/10.1111/bjet.12914>.

Hong Kong Curriculum Development Council. (2017). *Secondary education curriculum guide*. Hong Kong.

Independent Commission on Assessment in Primary Education (ICAPE). (2022). *Assessment for children's learning: a new future for primary education*. [online]. [Accessed 20 February 2023]. Available at: https://www.icape.org.uk/reports/NEU2762_ICAPE_final_report_A4_web_version.pdf.

Jerrim, J. (2016). PISA 2012: How do results for the paper and computer tests compare? *Assessment in Education: Principles, Policy and Practice* [online]. Vol. 23(4). [Accessed 12 March 2023]. Available at: <https://doi.org/10.1080/0969594X.2016.1147420>.

Kaur, A., Mohammad, N. & Awang-Hashim, R. (2018). Exploring and evaluating differentiated assessment practices of in-service teachers for components of differentiation. *Teaching Education* [online]. Vol.30(3). [Accessed 12 March 2023]. Available at: <https://doi.org/10.1080/10476210.2018.1455084>.

Kerr, K. (2017). Exploring student perceptions of verbal feedback. *Research Papers in Education* [online]. Vol.32(4). [Accessed 12 March 2023]. Available at: <https://doi.org/10.1080/02671522.2017.1319589>.

Ling, G. (2016). Does it matter whether one takes a test on an iPad or a desktop computer? *International Journal of Testing* [online]. Vol.16. [Accessed 11 March 2023]. Available at: <https://doi.org/10.1080/15305058.2016.1160097>.

Manchester Metropolitan University. (2023). *Observation Template Forms*. [online]. [Accessed 15 March 2023]. Available at: <https://www.mmu.ac.uk/about-us/professional-services/uta/peer-observation/observation-resources>.

Ministry of Education (MOE). (2022). *MOE Strategy* [online]. [Accessed 27 February 2023]. Available at:

<https://www.moe.gov.ae/En/AboutTheMinistry/Pages/VisionMission.aspx>.

Moursund, D. (2016). *Project-based learning using information technology* [online].

[Accessed 27 February 2023]. Available at: <https://moursundagatefoundation.org/>.

Nardi, A. & Ranieri, M. (2018). Comparing paper-based and electronic multiple-choice examinations with personal devices: impact on students' performance, self-efficacy and satisfaction. *British Journal of Educational Technology* [online]. Vol.50(3). [Accessed 11 March 2023]. Available at:

<https://doi.org/10.1111/bjet.12644>.

National Qualifications Framework (NQF). (2017). *Standard glossary of terms*

[online]. [Accessed 2 March 2023]. Available at:

<https://hr.saqa.co.za/glossary/pdf/NQFPedia.pdf>.

Punter, R. A., Meelissen, M. R. M. & Glas, C. A. W. (2016). Gender differences in computer and information literacy: an exploration of the performances of girls and boys in ICILS 2013. *European Educational Research Journal* [online]. Vol.16(6).

[Accessed 6 March 2023]. Available at: <https://doi.org/10.1177/1474904116672468>.

Shute, V. J., & Rahimi, S. (2017). Review of computer-based assessment for learning in elementary and secondary education. *Journal of Computer Assisted Learning*

[online]. Vol. 33(1). [Accessed 6 March 2023]. Available at:

<https://doi.org/10.1111/jcal.12172>.

States, J., Detrich, R. & Keyworth, R. (2018). *Summative assessment (Wing Institute*

Original Paper) [online]. [Accessed 4 March 2023]. Available at:

https://www.researchgate.net/publication/323946068_Summative_Assessment_Wing_Institute_Original_Paper#fullTextFileContent.

United Nations International Children's Emergency Fund (UNICEF). (2022).

Formative assessment. resource pack to support remote learning [online].

[Accessed 1 March 2023]. Available at:

https://inee.org/sites/default/files/resources/UNICEFWorldBank_ResourcePack7_Assessment.pdf.

Vidhiasi, D. M. (2018). *Classroom observation and research* [online]. [Accessed 14

March 2023]. Available at: [10.6084/m9.figshare.7988522](https://doi.org/10.6084/m9.figshare.7988522).

William, D. (2011). What is assessment for learning? *Studies in Educational*

Evaluation [online]. Vo.37 (1). [Accessed 14 March 2023]. Available at:

<https://doi.org/10.1016/j.stueduc.2011.03.001>.

Wise, S. L. (2019). Controlling construct-irrelevant factors through computer-based

testing: disengagement, anxiety, & cheating. *Education Inquiry* [online]. Vol.10(1).

[Accessed 12 March 2023]. Available at:

<https://doi.org/10.1080/20004508.2018.1490127>.

Yambi, C. (2018). *Assessment and evaluation in education* [online]. [Accessed 27

February 2023]. Available at:

https://www.researchgate.net/publication/342918149_ASSESSMENT_AND_EVALUATION_IN_EDUCATION#fullTextFileContent.

Yan, Z. & Boud, D. (2021). *Conceptualising assessment-as-learning* [online].

[Accessed 1 March 2023]. Available at:

https://www.researchgate.net/publication/352536831_Conceptualising_assessment-as-learning#fullTextFileContent.

Appendices

Appendix 1: Observation scheme

<https://www.mmu.ac.uk/about-us/professional-services/uta/peer-observation/observation-resources>

University Teaching Academy



Semi-structured observation form observer

Agreed focus of the observation (e.g. inclusivity, employability, specific technique etc.):

Key points from pre-observation discussion:
e.g. why did you select this topic for a specific-focus observation?

What I observed	Points to discuss and share

Examples of good practice include ...

Areas for development / discussion include ...