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# Assessment of/for/as online learning: Mathematics teachers' views on online assessment during the COVID-19 pandemic

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*Assessment is an important aspect of mathematics teaching and learning. This paper aims to explore Hong Kong mathematics teachers' views on online assessment during the COVID-19 pandemic. The data analysed is part of a larger project comprising an online survey and semi-structured interviews. This paper presents data from the survey responses of ninety-two teachers and from interviews of three teachers. Thematic data analysis is conducted, focusing on teachers' views on assessment during online learning. Findings show that the forms of assessment that Hong Kong mathematics teachers conducted during the pandemic were similar to those from before the pandemic. They view online assessment mainly as assessment for and of online learning. This paper also discusses suggestions for online mathematics assessment.*

*Keywords: Online teaching, assessment, mathematics teachers' views.*

## Background

Assessment plays a crucial role in supporting teaching and learning at school (Black & Wiliam, 1998, 2011). Harlen (2007) denoted assessment as “the process of gathering, interpreting and using evidence to make judgments about students' achievements in education” (p. 11). The students' achievements include their knowledge, attitudes, or skills. This process may occur inside or outside the classroom. Assessments can be formal (e.g., an examination or test) or informal (e.g., a conversation between teacher and student), external or internal. Moreover, according to their different functions, assessments can be categorised as summative or formative. Summative assessments refer to those that measure what students have already learned. Teachers may design them for several purposes, such as grading and selecting students, or evaluating experiences regarding a teaching unit. In contrast, formative assessment primarily focuses on informing learning and teaching by providing feedback to students and teachers (Curriculum Development Council [CDC], 2017; Hodge & van den Heuvel-Panhuizen, 2014). Regardless of the forms of assessment, teachers play an important role in the process of assessment (Black & Wiliam, 2011). During the COVID-19 pandemic, all the learning activities are conducted by online mode, including the assessments. Teachers' role became even more crucial during the pandemic. How to conduct online assessment may become challenges for many teachers.

Although assessment is an integral part of curriculum planning, pedagogy, and assessment cycles, there often exists “a major gap between the nature of the planned and implemented curriculum” (Morris, 1995, p. 43). For example, in Hong Kong, the formal curriculum stresses the formative role of assessment by teachers; however, when the curriculum is implemented, internal assessments are frequently based on those used in public examinations (Morris, 1995). During the online teaching, it is necessary to know whether such gaps still exist and how they have been changed. Online assessment refers to any form of assessment conducted during or after online learning, for example, online quizzes, online submissions of homework, online question sessions, and other online interactions. Although some teachers have previously used e-learning tools (such as Kahoot!,

GeoGebra, and Google Forms) to teach in traditional classrooms, conducting online assessment is a new challenge for most. Teachers' views on assessment can influence their teaching practices, especially in a new context, such as using online assessment during online teaching (Kaiser et al., 2017; Mirian & Zulnaidi, 2020). By using e-learning methods, teachers can give rapid and accurate feedback to students, which contributes positively to students' motivation for learning (Becta, 2003). However, many barriers and challenges also exist for teachers when conducting online teaching (Jones, 2004; Dhawan, 2020). For example, students in online courses may also feel isolated and disconnected from the instructor and other learners (Choy et al., 2002). The lack of student-teacher interaction in online classes is another primary concern (Mayes, 2011).

Because of the COVID-19 pandemic, teaching online has become a new normal approach worldwide. Given the significance of online assessment in mathematics classrooms, there is a need to examine how technology influences the forms of assessment teachers conduct and their experiences during online teaching. Hence, this paper aims to explore mathematics teachers' views on online assessment during the pandemic. Specifically, this paper investigates four research questions:

1. What kinds of assessment did mathematics teachers use during online learning?
2. What did teachers think of conducting online assessment during online learning?
3. What types of constraints did teachers face in conducting assessment during online learning?
4. How did teachers deal with the constraints on online assessment?

### **Assessment of/for/as learning in mathematics**

Assessment in mathematics can be both summative and formative. Summative assessment focuses more on providing a comprehensive and summary description of students' performance and progress in learning. On the other hand, formative assessment focuses more on diagnosing students' strengths and weaknesses in learning, providing feedback, and reviewing learning and teaching strategies (CDC, 2017). In general, assessment can serve the following three purposes: assessment *of* learning, assessment *for* learning, and assessment *as* learning.

Of these three purposes, assessment *of* learning aims to provide learners with results about what they have achieved in their learning within a certain period (Harlen, 2007). Assessment methods for this purpose include testing at the end of a class session, as well as formal examinations in the middle or at the end of the academic year. Assessment can sometimes also take the form of homework, whereby the teacher gives grades to learners. Next, according to Mok (2011) and Harlen (2007), assessment *for* learning uses assessment methods to provide learners with feedback to assist their future learning. Such methods focus on monitoring and providing feedback to learners during mathematics classes. They can take the form of question-and-answer (Q&A) sessions or classwork. Finally, assessment *as* learning uses assessment methods to develop self-monitoring (Earl, 2013) and self-directed learning (Mok, 2011) among learners. For such assessments, learners assume an active role in their learning process, unlike for the other two purposes, for which the teacher initiates the learning.

In existing literatures, the above concepts mainly apply to how teachers conduct assessment in physical learning contexts (see Black & Wiliam, 2011; Earl, 2013; Harlen, 2007; Mok, 2011). Conceptual frameworks for analysing teachers' views on assessment during online teaching and learning remain limited. Hence, we are proposing assessment of/for/as online learning as a framework to analyse teachers' views on online assessment during the pandemic. In this paper, online

assessments are not limited to strictly online forms, such as live Q&A sessions or online quizzes during online learning, but also include forms that involve a physical component, such as answering questions from textbooks or workbooks to be submitted after online learning.

## Methodology

This study examines data extracted from a large comparative study between Hong Kong and Italy, designed as an exploratory study to investigate mathematics teachers' views on online teaching and learning. Data presented in this paper is original and not have been published previously. The study comprised an online survey and semi-structured interviews following the survey.

## Participants

Participants were recruited by random sampling through emails and social media. A survey link was distributed online through social media. For this study, assessment-related responses from 92 Hong Kong mathematics teachers were selected, as shown in Table 1. Three interview cases in which "assessment" was mentioned were also selected to support the findings from the survey.

**Table 1: Background of selected teacher participants**

School level	Teaching experience (years)				Total
	<5	5–10	11–15	>15	
Primary	9	7	5	18	39
Secondary	31	10	4	8	53
Total	40	17	9	26	92

## Instrument

A team of researchers from Hong Kong and Italy designed the online survey instrument, which comprised 13 items. Four items captured background information, while the other nine open-ended questions related to teachers' views on online teaching and learning. For instance, item 9 read: "During distance teaching, do you think that your way of teaching mathematics somehow changed? Please explain." Teacher participants were required to state whether any changes in their teaching practices occurred during the pandemic and to provide explanations for them. This paper presents the data extracted from the nine open-ended questions, comprising responses related to assessment during the pandemic.

## Data analysis

Data were imported into the analytical software NVivo 12 Pro to conduct thematic analyses on both survey and interview data. For both sets of data, the original interview transcripts in Chinese were used to prevent important information from being lost during translation. Translations are only done for data presented in the results.

Themes related to assessment, such as online assignments, classwork, homework, tests, and evaluations, were first identified from the survey data. Then, similar themes were combined and

merged into four major assessment methods: classwork or homework, live Q&A, tests or quizzes, and evaluations. Meanwhile, data related to constraints on and unsuccessful implementations of assessment were coded under the node constraints. Thereafter, based on the proposed framework regarding views on assessment, the data was further coded according to the purposes of “assessment *for* online learning”, “assessment *of* online learning”, and “assessment *as* online learning”. The numbers and percentages of teachers in each coding category were then recorded and calculated. For the interview data, themes that expressed positive and negative views were grouped separately to provide more information about teachers’ views.

## Results

### Online survey

There were 92 teachers who mentioned “assessment” during distance learning in online survey. Table 2 shows that teachers used four main types of assessment during distance learning and the constraints related to the forms of assessment used. 42.39% of teachers used classwork or homework to assess student’s learning. For example, one teacher mentioned, “[I] gave students assignments through Google Classroom, marked them and returned them to students.” About 6.52% of teachers mentioned they posed questions during online teaching sessions to assess students’ understanding. For example, another teacher responded that “[I] need to ask questions frequently to know their learning progress.” 16.30% of teachers revealed they had conducted online tests or quizzes to assess their students’ understanding, using online platforms such as Kahoot! and Quizizz. A third teacher mentioned that they dealt with distance learning by using “some online interactive platforms, for example, Kahoot! and Nearpod are used to get feedback from students.” Lastly, 11.96% of teachers mentioned that they used assessment for general evaluation, without specifying in which form, such as “[I] used Google Meet to follow up student’s learning progress too.”

**Table 2: Forms of assessment used and constraints faced by Hong Kong mathematics teachers during the pandemic**

	Classwork/homework (%)	Live Q&A (%)	Test/quiz (%)	General evaluation (%)
Forms of assessment	42.39	6.52	16.30	11.96
Constraints	23.91	7.61	10.87	44.57

There was 44.57% of the 92 teachers disclosed their unsuccessfulness or difficulties in conducting assessment during distance learning for general evaluation (Table 2). As one teacher mentioned, “[it was] more difficult to assess student’s level of understanding and did not manage to conduct assessment for learning effectively.” 23.91% of teachers reported constraints in assigning, monitoring, marking, or collecting classwork or homework. For example, they were unsuccessful in “monitoring students’ progress in doing classwork”. Meanwhile, 10.87% of teachers said they struggled to conduct a test to assess their students’ learning progress. For example, another teacher said that “a test could not be held”. Lastly, 7.61% of teachers reported difficulties in conducting assessments during online live teaching; a teacher stated, “[I] did not manage to ask different types of questions to students to assess their learning progress”.

There were 61 teachers who provided explicit descriptions about their views on online assessment, as shown in Table 3. Of these 61 respondents, 39.34% viewed assessment as being *for* learning in general. Most of these respondents gave general answers about assessment purposes, such as monitoring students' progress. 37.70% of teachers view assessment as being *for* online learning through classwork or homework. For example, one teacher mentioned, "[I] used Google Forms for homework" to deal with online teaching and learning during the pandemic, reflecting the purpose of assessment *for* online learning. Lastly, 24.59% of teachers viewed assessment as being *of* online learning through tests or quizzes. As reported in their survey responses, they manage to "[conduct] evaluation of learning progress [by using] Quizizz App", reflecting the purpose of assessment *of* online learning.

**Table 3: Teachers' views on online assessment during the pandemic**

Views on assessment	Classwork/ homework (%)	Live Q&A (%)	Test /quiz (%)	Evaluation (%)
Assessment for online learning	37.70	16.39	9.84	39.34
Assessment of online learning	6.56	0	24.59	4.92
Assessment as online learning	11.48	1.64	1.64	1.64

### Online interviews

Data analysis of the online teacher interviews revealed that overall, Hong Kong mathematics teachers had differing views about the conduct and outcome of assessment. This section describes three cases selected from the interview data to represent teachers with negative, positive, and mixed views, respectively. The negative views recorded such as assessment being difficult, problematic, and ineffective, positive views included technology tools have made the assessment easier and mixed views with both positive and negative aspects.

Janet, a secondary mathematics teacher with less than five years of teaching experience, hold a negative view about online assessment. She thought online assessment was difficult to be conducted. She changed from grading students' homework using Google Classroom to assigning homework and conducting live teaching through online platforms such as Zoom and Kahoot! to assess students' learning. She commented:

It was very difficult to assess [students' learning]. This was because they may not complete their homework alone. [Then], last time in school, a short test could be conducted [during the lesson]. [But] now [the test] cannot be conducted because it [would be] unfair to [other students] if we conducted [the test] with them.

Janet's responses reflected her emphasis on assessment *for* online learning to assess students' learning during live teaching and through assigning homework. However, constraints existed for the effectiveness of online assessment through homework, in the sense that certain students might not complete their homework independently (assessment *as* online learning). Besides, she had concerns about the validity and fairness of conducting tests (assessment *of* online learning).

Conversely, Nick, a secondary mathematics teacher with less than five years of teaching experience, viewed using technology in assessment positively. He used Zoom for live Q&A to help students who

had problems with homework and Google Forms to assess students' learning during distance learning (assessment *for* learning).

In my opinion, since we have to use technology [now], [then] we have to fully utilise it: why use [the technology] just because we have to? ... From the online teaching and learning perspective, objective questions are easier [for students to handle] ... In my view, students' self-discipline is very important in the online [teaching and learning] mode.

Nick focused on live Q&A to assist students in their learning, whereby students had to take initiative to ask questions during live teaching sessions (assessment *as* online learning). He then used multiple-choice questions instead of written questions to evaluate his students (assessment *of* online learning) during the pandemic. He changed his assessment methods to enable students to answer questions. Furthermore, he emphasised the importance of assessment *as* online learning during online teaching and learning.

Lastly, Marry, a primary mathematics teacher with over 15 years of teaching experience, held mixed views on online assessment. During distance learning, she used the online platform Power Lesson to upload video recordings and assign exercises to students. She also assigned more multiple-choice questions to students online (assessment *of* learning). However, due to requests from parents, she started to incorporate live Q&A via Zoom (assessment *for* learning) into existing assessment methods:

You will feel like you are talking alone. I do not know whether they learned something or not, whether they completed [their work], I do not know too. So, I feel the difficulty is I have to treat them as [if] they [had] never [learned it] before.

For Marry, her initial approach to assessment reflected her view of assessment *as* online learning, whereby students completed assigned exercises by themselves after watching her video recordings. Her comments on not receiving responses from students during live teaching sessions reflected constraints in assessment *for* learning. During the interview, she further commented that it was problematic that students did not cooperate during group work (assessment *as* learning). Then, she could not request students to write their answer on the whiteboard (board work) and review their work during live teaching (assessment *for* learning).

## **Discussion**

The present study aims to explore Hong Kong mathematics teachers' views on online assessment during the COVID-19 pandemic. Findings show that the online assessments that teachers conducted during online learning were similar to the face-to-face assessments they conducted during in-person learning. These assessments would be conducted during class time, such as through classwork and Q&A sessions. Then, homework or tests were assigned or conducted at the end of class. Mok (2019) reported similar features in the data collected during 2016: normal face-to-face assessments in Hong Kong mathematics classes took the form of individual classwork, with the teacher walking between desks to monitor students' learning progress. The finding shows most Hong Kong mathematics teachers viewed assessment as being *for* online learning and *of* online learning during the pandemic. Teachers paid more attention to what students learned from the class and valued their performance. This may be due to cultural influences, such as the Chinese culture and the culture of examinations (Wong et al., 2012). Teachers also acknowledged the importance of students' autonomy in online assessments, which reflected the purpose of assessment *as* online learning.

The constraints that Hong Kong mathematics teachers reported primarily concerned the effectiveness of online assessment, as well as students' autonomy in completing homework and participation in live teaching sessions. The constraints that were reported, especially regarding students' autonomy were common challenges that teachers worldwide faced during online learning (Dhawan, 2020). To overcome these constraints, most teachers who viewed assessment as being *for* online learning tried to conduct live teaching and ask more questions during teaching. Teachers who viewed assessment as being *of* learning used more multiple-choice questions to assess students online instead of subjective or problem-solving questions. Nevertheless, teachers who viewed assessment *as* learning posted the answers to classwork or homework online for students to check their work by themselves, or hosted live teaching sessions for students to ask questions.

## Conclusion

This study examined current mathematics teachers' views on online assessment during the pandemic. It provided insights into how technology influences the forms of assessment that teachers use and their experiences during online teaching. First, the findings revealed that online assessments conducted during the pandemic were similar to in-person assessments conducted before the pandemic. This implies that mathematics teachers' existing conceptions of teaching may be very strong and not easily changed, even when the teaching environment has changed. Second, teachers' views on online assessment and its constraints in various forms revealed that effective strategies to shape students' autonomy in online learning are needed. More teacher training must be given to teachers in terms of how to conduct online assessment. Information technology is no longer a supplement to teaching and learning, but has become the new norm in a post-pandemic era. The teaching modes that schoolteachers use therefore need to be more flexible to meet the changing times. In terms of our study, we acknowledge that our sample size is not large enough to generalise our findings. Future studies on this topic can be conducted by adopting different methods, such as large-scale questionnaires. Data from students could also provide another perspective on the effects of online assessment.

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