Launched in May 2016 by the Office of Education Research at the National Institute of Education, Singapore, OER Knowledge Bites aims to share education research discussions and issues as seen in the Singapore context. It also serves as a platform for researchers to share thoughts and concepts of education research with policymakers, educators and the public.

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About this Volume
The Office of Education Research (OER), in collaboration with the Academy of Singapore Teachers, organised a seminar on differentiated instruction (DI) and assessment on 2 September 2019 at Nanyang Girls’ High School. The seminar, themed “Leveraging Assessment in a Differentiated Classroom”, generated discussions among educational researchers and practitioners on shifts in assessment policy and practice in Singapore, and the growing importance of DI and Assessment for Learning (AfL) as strategies for teachers to enact in the classroom. This volume of OER Knowledge Bites provides a summary of the talks.
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Exploring the Link between Assessment and Differentiated Instruction

By Heng Tang Tang & Song Lynn

Heng Tang Tang is Assistant Professor at the Policy, Curriculum and Leadership Academic Group, National Institute of Education (NIE, Singapore). Song Lynn is a research associate at the Policy, Curriculum and Leadership Academic Group at NIE.

Differentiated Instruction (DI) is an approach guided by key principles and philosophies of diversity and equity where teachers take a proactive, intentional and systematic response to maximise students’ potential through the modification of four classroom elements: content, process, product, and affect or environment (Tomlinson, 2017). This approach is premised upon five principles: i) an environment that encourages and supports learning; ii) quality curriculum; iii) assessment that informs teaching and learning; iv) instruction that responds to student variance or differences; and v) leading student and managing routines. Assessment plays an integral role in DI because it provides teachers with actionable information to determine where their students are relative to the curricular goals, and therefore make purposeful instructional plans that would boost student learning (Tomlinson & Moon, 2013).

A Study of How Teachers Implemented DI in Singapore: Preliminary Findings on Assessment Practices

This article is part of a larger research that explored how five primary and five secondary school teachers teaching either English Language, Mathematics or Science implemented and experienced DI in Singapore. We conducted 39 lesson observations in total and 3 interviews with each teacher. In addition to Tomlinson’s (2013) student variance of readiness (i.e., “proximity to specified learning goals”), interests and learning profile (i.e., “preferred approaches to learning”) (p. 2), this study also considered learner profile (elements that shape learners and their identity such as gender, nationality, home environment, etc.).

Preliminary findings indicate that participants collected information on students that allowed them to feed forward into instructional practices, most frequently for readiness, followed by learner profile, learning profile and interest. Participants suggested that the heavy focus on readiness assessment could be due to: societal emphasis on grades, accountability of student performance to school, parents and students, teacher performance evaluation, and ease and convenience of readiness assessment. Preliminary findings also suggest that participants exhibited moderate evidence in using formative assessment (FA) to glean information on learning, but weak evidence in using the information collected to adjust instruction. While findings suggest that participants are comfortable using FA in the classroom, participants shared that they struggled with instructional adjustment because they were not aware of how to make adjustments, found it consuming, faced competing school commitments, and were concerned about the efficacy of DI. Finally, preliminary findings indicate that there was weak evidence of participants promoting learner independence by encouraging self-directed learning and self-assessments. Participants explained that the culture of learning remains teacher-directed, students lack confidence and motivation, and self-regulation was difficult without parental support.

Possible Implications of Findings

Professional sharing and personal reflections can help teachers move beyond an over-emphasis on readiness to consider assessment, not just for improving learning, but for understanding students holistically. For instance, teachers could keep an interest inventory of their students or seek student feedback on reflection questions like “What I’d like my teacher to know?” and “How did you feel about today’s activity?”

In response to challenges around using formative assessment to inform instructional differentiation, teachers could work collaboratively in schools and across schools, tap into OPAL for resources, and utilise technology like Flubaroo, Gradecam and Pickers. Utilising peer assessment and providing answers for self-checking could reduce teachers’ marking load and increase self-direction and self-assessment among students. Most importantly, teachers embarking on DI would do well to start small, start clear, and take heart that changes around teaching and learning is a long-term work that might not bear fruit immediately, but eventually will.

References


How to Cite

Assessment for Learning (AfL) implementation faces resistance in environments where sociocultural codes of summative assessment are entrenched (Kennedy, Chan, Fok, & Yu, 2008; Leong, Ismail, Costa, & Tan, 2018). Investigating the perceptions and practices of AfL in relation to the wider societal and global context helps practitioners and policymakers bridge the gap between the enactment of AfL in schools and its intended policies. Through this study, we hope to investigate the perceptions, policies and practices of AfL in Singapore secondary schools to establish a systematic understanding of AfL that may inform research, policy, practice and development.

**Key Findings**

Teachers reported valuing learner-centred AfL (e.g., self- and peer-assessment) more than they reported practising or feeling proficient in it. The qualitative data showed that teachers constantly toggle between AfL practices that focus narrowly on exams (more predominant) and those with deeper learning goals. Overall, the findings suggest that, while AfL has gained traction among secondary-school teachers, they also reflect ambivalence in negotiating the formative and summative expectations of policy and practice.

School leadership and culture are the most direct mediating influences affecting teachers’ perceptions of AfL. School leaders and key personnel have a more heightened awareness of alignment issues of formative and summative assessment, and they are more able to exercise certain forms of assessment leadership to support their teachers in enacting AfL sustainably. Such findings highlight that teachers need more coordinated support within their school (beyond attending workshops) in negotiating priorities to plan and execute AfL practices that are not too narrowly focused on exams. With an increase in curriculum spaces created from the recalibration of weighted assessment across all schools, we are optimistic that a “broader alignment” version of AfL can be more widely introduced with appropriate assessment leadership.

**Significance of Findings**

Based on the findings, the research team has recommended an AfL process (“Explaining Intended Learning Outcomes”, “Exploring Learning”, “Engaging in Quality Feedback”) in a brochure and poster to be sent to secondary schools (see: https://sites.google.com/view/ctl-assessment/AfL). We envisage that this version of AfL can be more systematically introduced through:

- Fleshing out of (in particular) “assessment and feedback” pedagogical practices (vis-à-vis other pedagogical practices) in the Singapore Teaching Practice (STP).
- Highlighting the connectivities of teaching areas and practices within STP—give examples of how such connectivities work in different subjects.

More examples of case studies of how different subject teachers have planned and enacted learner-centred AfL in classrooms can be found here: https://knowledgebank.nie.edu.sg/afl.html. They illustrate how AfL can and should be adapted in different subject and classroom contexts.

**Research Design**

This research used a mixed-method design. Quantitative data was collected using a survey, while the qualitative interview and observation data was coded inductively.

In total, 1,119 school leaders, key personnel and teachers from 13 secondary schools participated in the survey. From the 13 schools, 7 schools participated in the second phase, where a school leader, middle manager, 3 teachers and 15 students from each school were interviewed and/ or observed.

**References**


**How to Cite**

Perceptions of Singaporean Primary Students: What is Self-Assessment and Feedback to Me?

By Wong Hwei Ming

Wong Hwei Ming is a Research Scientist in the Office of Education Research, National Institute of Education (Singapore).

In a rapidly changing and globalising world, the Ministry of Education, Singapore has been changing its assessment mode to incorporate Assessment for Learning (AfL) into the curriculum. With this in mind, the focus of this research was to examine self-assessment as an AfL strategy that would engage students to deliberately reflect on what they are learning and how they are learning it (Wong, 2017), while using feedback from teachers to make efforts to improve their own performance. The research team wanted to elicit empirical evidence of the efficacy of academic self-assessment in the lower primary classroom context from the perspectives of students.

Purpose of Study
This study aimed to develop a systematic method of implementing self-assessment in lower primary school classrooms while examining changes, if any, in these students’ perceptions of self-assessment over time. In addition, the study examined the kinds of feedback teachers gave to students, and how these students perceived and used the feedback to support their own learning.

Research Design
A total of 160 Primary 3 students from five classes were administered a Self-Assessment Questionnaire twice within the year. The research team conducted a one-hour training session to explain the purpose of self-assessment as well as demonstrated the different descriptor levels for self-assessment criteria using exemplars. Students completed self-assessment rubrics twice a week. Five randomly selected students per class participated in focus group discussions on their perceptions of self-assessment and feedback. Each teacher was observed for an instructional unit of work with a focus on teacher feedback.

Findings and Implications for Practice
The data from the questionnaire (n=160) and focus group discussions (n=24) were triangulated, and the findings and implications for practice and policy are summarised in Table 1 on the following page.

In summary, the findings indicated that self-assessment training for students is necessary and could be implemented systematically. Self-assessment and feedback are also necessary skills and knowledge for pre-service and in-service teachers. More importantly, teachers’ and students’ mindsets, engagement and commitment are important components for the sustained implementation of self-assessment.

References

How to Cite
Findings | Implications for Practice and Policy
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Students reported that the self-assessment training was important and they were better able to assess themselves using the rubrics. | Self-assessment training for students is necessary and could be implemented systematically (see also Safii & Wong, 2017; Wong, 2016). |
Majority of students felt that they are capable of self-assessing on their own. | Students could be provided with more opportunities for self-assessment as well as more time for reflection on their work. |
More than half of the students felt that they needed more practice to be confident in self-assessing their work. | |
Majority of students wanted more opportunities for self-assessment while some wanted more time for self-assessment. | |
Students were more willing to share their self-assessment with parents than with teachers because they were afraid of repercussions and lacked confidence. | A safe learning environment is essential where mistakes are stepping stones to mastering concepts, skills and knowledge. |
Students shared that they learnt most about independent learning, followed by knowledge application, motivation and communication. | A safe learning environment is essential where mistakes are stepping stones to mastering concepts, skills and knowledge. |
Students felt that descriptive feedback was most important to them while phatic feedback (e.g., tick and flick; see Murtagh [2014]) was least important for their learning. | Besides giving descriptive (detailed) feedback, teachers can consider teaching students to think about their strengths and weaknesses and how they can improve their work. |
Students personally liked to receive self-feedback (e.g., praise, "I am proud of you"), followed by task feedback and lastly, process feedback. There was no mention of self-regulation feedback. | There is a place for different types of feedback, including self-feedback, which younger students viewed as affirmation from teachers. Teachers could consider providing more self-regulation feedback and support to students. Teachers could also consider following up on feedback given to students, to make sure students understand and there are opportunities to use the feedback. |
Students shared that teachers gave them mostly task feedback, followed by self-feedback and lastly, process feedback. There was no mention of self-regulation feedback. | |

Table 1. A summary of the findings and implications for practice and policy.
An Introduction to the Cognitive Diagnostic Assessment System

By Vahid Aryadoust & Loh Chin Ee

Vahid Aryadoust is Assistant Professor and Loh Chin Ee is Associate Professor at the English Language & Literature Academic Group, National Institute of Education (Singapore).

The cognitive diagnostic assessment system (CoDiAS) is an online reading assessment system that aims to assess the reading ability of secondary school students in Singapore. It has three assessment components that are delivered via secured internet platforms: (i) a pre-test administered to students as the start of the program; (ii) treatments: a series of texts, assessment tasks, and feedback; and (iii) a post-test administered to students at the end of the program to measure their progress. The tests and treatments were developed in an iterative process that involved the investigators and three experienced school teachers. The tests were administered in two schools and the results of the pre-test were validated psychometrically using Rasch measurement—the analysis of the treatments and the post-test is ongoing. In what follows, we will discuss its theoretical framework of CoDiAS and the steps in developing the system.

Theoretical Framework

The definition and operationalisation of CoDiAS were informed by the construction-integration (CI) model of comprehension (Kintsch, 2004). The CI model defines comprehension as a two-stage process. In the first stage, which involves the literal comprehension of the text, the reader recreates a literal representation of the idea units in the text—this is called the textbase. In the second stage, readers incorporate their own world knowledge or topical knowledge to close the gaps in the textbase and generate a cogent and coherent mental representation called the situation model. The teachers in this study were trained to develop test items engaging these comprehension processes.

Development of CoDiAS

There were three main steps to develop the test materials and test items. First, a large pool of texts (n=1,000) that were deemed suitable for secondary school students was developed. This included a number of genres and themes including sociology, biology, news reports and narratives. Next, we used text analysis software to measure textual features of the texts. The analysis identified a group of homogenous texts, which were adopted to create the tests and the treatments. Three experienced teachers were trained to select texts and develop test items. They used a coding scheme to determine whether the texts were difficult, medium or easy with reference to their perceived ability of Secondary 2 and 3 students. In addition, three texts were chosen for the pre-test, one of which was used as the link between the pre- and post-tests. The post-test also consisted of three texts (including the linking text). The treatments consisted of a passage, relevant test items and feedback.

The students were required to take the pre-test, based on which they would be directed to take suitable treatments, depending on their performance on the pre-test. Next, according to their performance on the first treatment, they would proceed to the following treatment. For example, if they managed to answer 60% of test items in treatment 1, they would be assigned a treatment of a higher difficulty. Therefore, some students would complete the treatments over a short period of time, whereas others would spend more time reading, practicing and receiving feedback.

Psychometric Validation

So far, we have investigated the psychometric validity of the pre-test using Rasch measurement. We found that the test items had a range of difficulty levels as expected and the texts were different in their cognitive difficulty level.

Conclusion

The main aim of the CoDiAS project was to assess students’ reading skills and provide them with treatments and feedback. Students’ evaluation of the system was fairly positive despite a few technical glitches encountered during the administration of the tests and treatments. We aim to scale up the system to more schools and develop an automated writing evaluator to complement the reading assessor.

Reference


How to Cite

Drawing as an Alternative Mode of Assessing Primary School Students' Scientific Conception

By Jennifer Yeo and Wu Pu Wen

Jennifer Yeo is Assistant Professor at the Natural Sciences & Science Education Academic Group, National Institute of Education (Singapore). Wu Pu Wen is a participant of Jennifer Yeo’s research project “From Images to Writing: A Formative Assessment Approach for Developing Understanding of Abstract Concepts in Primary Science”.

As teachers seek to reflect children’s diverse experience in the subject matter they present and in the questions they explore, they must also embrace children’s multifaceted ways of knowing. Drawing can be an alternative mode of finding out what children know or think.

What Can’t Words Tell that Drawings Can

In a study (AFR 02/15 JY), we observed how drawings can better clarify the meanings students were making in their written explanation about a phenomenon. Figure 1 is a case in point.

While the written explanation indicates misconception as heat does not get “trapped” but transferred at a slower rate, the drawing makes clear the conception that there is heat transfer to the surroundings. The informal drawings are similar to how scientists draw to clarify ideas for colleagues, students and the public (Kozma, Chin, Russell, & Marx, 2000). This is perhaps especially relevant to the budding learners who are still developing their formal scientific language capabilities.

A Three-Step Teaching Sequence for using Drawings in Formative Assessment

As students’ drawings can sometimes be hard to decipher, we introduced a three-step teaching sequence for formative assessment (see Figure 2).

We provide below two examples of its enactment in a primary science classroom during an activity on germination.

Background of Lesson

Figure 3 below shows a summary of the background of lesson. In this activity, students worked in groups to produce drawings of their observations of the seeds.

<table>
<thead>
<tr>
<th>Theme/ Topic/ Sub-topic</th>
<th>Cycles/ Reproduction in Plants/ Germination</th>
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<tbody>
<tr>
<td>Class size</td>
<td>36 Primary 5 students (Middle progress)</td>
</tr>
<tr>
<td>Duration</td>
<td>2 periods (1 hour)</td>
</tr>
<tr>
<td>What was done</td>
<td>In this episode of lesson, the students were each given a packet of green bean seeds prior to the lesson. They were tasked to wet the cotton wool with the seeds in it, and observed what happened to the seeds over a period of three days. They also needed to record their observations on the worksheet given.</td>
</tr>
</tbody>
</table>

Figure 3. Background of lesson.
Figure 4 above shows the drawings produced by different groups of students for Day 1.

The teacher wanted to find out what the students meant by their description of “stay the same”, thus he sought to clarify their meaning in the “explore” stage. After understanding what the students meant, he got the class to evaluate if the description was sufficient in view of what was drawn of their observations and the pictorial and written descriptions produced by the other groups in the “work-on” stage. Finally, he reviewed their learning by highlighting the need to be more detailed in describing their observations and getting the students to refine their description in their worksheets.

In another instance, the teacher made use of their drawings to indicate specialised names to parts of the seed during germination.

The teacher first got the students to use their drawings to describe their observations (explore) to clarify what the students meant by the terms like “stem” and “leaf”. The teacher then helped them to make more detailed observations (e.g., “do you all see this part?” and introduced technical terminologies (e.g., “which we call the shoot”) to replace the less-technical terms used (work-on). Finally, he made clear of these new terms introduced (review).

**Potentials in the Use of Drawings for Formative Assessment**

The enactment of the teacher in the two episodes shows some of the ways in which teachers can use drawings for formative assessment in the science classroom. They can consider using drawings to clarify the ideas brought forth by students in writing, highlight entities and processes observed in an experiment or make clear what scientific terminologies might refer to.

**How to Cite**
