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Author(s)	Fei Victor Lim

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A Design-Based Research Approach to the Teaching and Learning of Multiliteracies

Fei Victor Lim

victor.lim@nie.edu.sg

National Institute of Education, Nanyang Technological University, 1 Nanyang Walk, Singapore 637616, Singapore

Abstract Against the backdrop of the expansion of the literacy curriculum to include multiliteracies in education systems around the world, we discuss how a design-based research approach can contribute to practical outcomes in building the participating teachers' confidence and competence in their pedagogical practices, developing scalable lesson resources for other teachers to use and adapt, and distilling design principles that can inform the teaching of multiliteracies across contexts. In this paper, we introduce the research project we have implemented based on a design-based research (DBR) approach and describe the features of the project in relation to the characteristics of DBR. We highlight the focus in DBR to improve practice and discuss how the classroom practices of the participating teachers have improved. We also draw on the perceptions of the teachers from the interviews and reflections they have made and suggest that they have grown professionally in their confidence. Through the co-design sessions between the researchers and teachers, we have distilled design principles, that is the learning processes for the teaching and learning of multiliteracies. These learning processes are applied to guide the design of the lesson packages as resources for teachers. While it is well-recognized that teachers are critical in the implementation of curricular reforms, we are interested to understand how researchers and teachers can work together through a design-based research approach to fully implement the curricular reforms.

Multiliteracies in the Curriculum

The New London Group (1996) introduced to the world the idea of 'multiliteracies' where the 'multi' in 'multiliteracies' stands for the "enormous and significant differences in contexts and patterns of communication ... and the 'multi' of multimodality", which refers to the various modes of meaning-making, such as images, sound, gestures, animations (Cope & Kalantzis, 2015, p. 3). Multiliteracies refers to the expanded notion of literacy beyond language learning. It is about the variability of meaning-making in different cultural, social or domain-specific contexts and requires that learners recognise and engage with differences in patterns of meaning from one context to another. Multiliteracies is also about the increasing multimodal ways meanings are made in the digital age. 'Multiliteracies' was an idea which, because of its relevance and relatability, spread rapidly across the world—inspiring education research, informing literacy curricula, and influencing classroom practices.

Today, more than 25 years since the publication of the multiliteracies manifesto by the New London Group, educational systems around the world have included tenets of multiliteracies

in their literacy curriculum. For example, apart from Singapore, the site of our study, the Finland core curriculum for basic education (Finnish National Board of Education, 2016) require students to interpret, evaluate and create both print and digital multimodal texts (Rasi et al., 2019). The tenets of multiliteracies have also informed the curriculum in Greece where the lifeworlds of the students were incorporated into the teaching and learning in the classroom (Tressou et al., 2015) and where primary school students learnt about multimodal meaning-making in digital environments (Karatza, 2020). Likewise, in the Asia–Pacific region, the Australian English curriculum (Australian Curriculum, Assessment & Reporting Authority, 2021) has identified the outcomes of developing students’ knowledge, understanding and skills in listening, reading, viewing, speaking and writing by exposing students to multimodal texts, in spoken, print and digital contexts and they will learn to interpret, appreciate, evaluate and create those texts. In tandem with the expansion of the curriculum, researchers in Australia have also developed pedagogies for teaching of multiliteracies in the English classroom by drawing attention to the ways in which meanings can be made multimodally (Bull & Anstey, 2019) and introducing metalanguages for multimodal meanings (Macken-Horarik, 2017; Unsworth, 2014). In Hong Kong, researchers have championed for the embedding of multiliteracies practices, such as multimodal composing into the English Language curriculum (Hafner, 2014) and the importance of guiding students in multimodal meaning-making (Hafner & Ho, 2020).

In this paper, we focus on one aspect of multiliteracies, that is on multimodal literacy. Jewitt and Kress (2003) introduced the term ‘multimodal literacy’ to describe “the meanings that are made, distributed, received, interpreted and remade in interpretation through many representational and communicative modes” (p. 1). Multimodal literacy involves the ability to use and combine different semiotic modes in ways that are appropriate to a given context (van Leeuwen, 2017). Multimodal literacy focuses on the aspect of multimodal meaning-making in multiliteracies. It involves a codified set of knowledge and skills, as well as a semiotic awareness demonstrated in students through their viewing and representing with multimodal texts in contextually appropriate ways (Lim & Tan, 2023). In Singapore, multimodal literacy has been essentialized as the viewing and representing with multimodal texts (Lim et al., 2021).

Multimodal Literacy in Singapore

Like many of these countries, Singapore has also progressively incorporated aspects of multiliteracies into the English Language Syllabus in 2010, where viewing and representing of multimodal texts, that is multimodal literacy, were added as communicative skills alongside language skills, such as speaking, listening, reading and writing. In Singapore, all students in the public mainstream schools study English Language as a compulsory first language for 10 years at the primary (junior school) and secondary levels (high school). In the current English Language Syllabus 2020 (ELS, 2020), multiliteracies is explicated as one of the three foci, along with metacognition and inquiry through dialogue. Teachers are expected to teach multiliteracies by guiding students’ viewing and representing with multimodal texts, in addition to the teaching of language skills. In this way, the syllabus draws attention to the recognition of the “multi-dimensional nature of literacy” (Curriculum Planning & Development Division, 2018, p. 16). Teachers are required to teach ‘information, media and visual literacy skills appropriate to the teaching of listening, reading, viewing, speaking,

writing, and representing ... [that] will strengthen students' ability to use a range of semiotic modes to create texts, including multimodal and hybrid texts, which are coherent and cohesive' (ibid).

The description of viewing is nestled amongst one of the specific aims of ELS 2020 to develop students' ability to 'listen to, read and view critically and with accuracy, understanding and appreciation a wide array of literary and informational texts in standard English from print, non-print and digital networked sources.' (Curriculum Planning & Development Division, 2018, p. 9). In terms of representing, the aim of ELS 2020 is to develop students' ability to 'speak, write and represent in standard English that is grammatical, fluent, intelligible and appropriate for different purposes, audiences, contexts and cultures' (ibid). ELS 2020 states that students are expected to develop the 'ability to use a range of semiotic modes to create texts, including multimodal and hybrid texts, which are coherent and cohesive [and] consistent with the intended purposes for text creation' (Curriculum Planning & Development Division, 2018, p. 16).

In Singapore, work in advancing the teaching and learning of multimodal literacy has been championed by several researchers over the years. Ho (2010) also showed how an innovative technologically enhanced learning environment can potentially develop students' multimodal knowledge in the English Language curriculum. Her findings indicated that students can develop a multimodal semiotic awareness, that is a sensitivity to the semiotic modes' affordances and constraints, in addition to collaborative skills and learning motivation. Exploring the process of students' producing multimodal representations of scientific knowledge, Towndrow et al. (2009) concluded that teachers' conscious inclusion of multimodality in the learning task design could promote students' competency in engaging with semiotic work with modalities. Responding to the changes in the Singapore English Language curriculum in 2010, Chia and Chan (2017) led the way in pre-service training of primary school teachers by developing frameworks to support their teaching of multimodal literacy. Working with secondary schools in Singapore, we developed metalanguages to provide conceptual tools for students think and talk about multimodal meaning-making across text types such as print advertisements (Lim & Tan, 2017), films (Lim & Tan, 2018), and educational apps (Lim & Toh, 2022).

More recently, researchers have examined the perceptions and practices of English Language teachers and students in the primary and secondary schools towards the teaching of multimodal literacy (Lim et al. 2022a).

Stemming from these findings, we identify the anxieties and the lack of professional preparation that teachers have towards the teaching of multimodal literacy. In light of the challenges reported, we conceived of a multi-phase research project based on the design-based research approach to build up teachers' confidence and capacity to teach multimodal literacy. While it is well-regarded that teachers are critical in the implementation of curricular reforms, we are interested to understand how researchers and teachers can work together through a design-based research approach to implement the curricular reforms. In this paper, we describe the features of this design-based research project and highlight the changes we observed from the teachers' pedagogical practices in the classroom. We also reflect on the implications the design-based research approach holds for partnerships between education

researchers and teacher practitioners towards the successful implementation of curricular innovations, as exemplified by the need to teach multimodal literacy in the English Language classroom.

Our Design-Based Research Project

In this section, we describe the features of a design-based research project in relation to our research project on multi-literacies in Singapore. First, a design-based research project is pragmatic in that it aims to solve real world problems by designing and implementing interventions alongside refining design principles and extending theories (Brown & Campione, 1996). In our project, the challenge is how to bring about the pedagogic shifts needed for the curricular changes as we respond to the literacy demands in today's communication environment. The goal in our research project is to bring about teacher learning as well as to develop learning design principles, instructional strategies, and lesson packages for the teaching of multiliteracies, in the English Language classroom. In an earlier paper (Lim & Nguyen, 2021), we had traced a single case-study of a teacher and highlighted her growth in confidence and competence to teach multimodal literacy through her participation on the design-based research project. In this paper, we focus on the aspect of teacher learning and discuss how the research project has brought about a shift in the ways the participating teachers teach multimodal literacy in the classroom. In particular, we focus on the changes observed in the teacher's discourse as analyzed from their lesson microgenres (O'Halloran, 2004; Lim, 2021).

Second, a design-based research project is grounded in specific theoretical underpinnings to inform practice. The theoretical frame in our project is guided by the earlier work of the education researchers in applying functional literacy approaches and multimodal studies in the teaching of multiliteracies. As mentioned, teachers have expressed uncertainties on how best to teach multimodal literacy (Lim et al. 2022a). To address this uncertainty, the researchers turned to available academic research for frameworks on analysing multimodal meaning-making to inform the teaching of multimodal literacy. Specifically, for this project, the researchers used the Learning by Design Framework (New London Group, 1996) as the main pedagogical approach, and visual grammar (Kress & van Leeuwen, 2006) to inform the pedagogic metalanguage for the interpretation and creation of multimodal texts. The researchers introduced these frameworks to the teachers and the professional learning for the teachers involved two stages—seminars and lesson co-design sessions. While informing practice, the reflexive process of working with the teacher participants also serves to refine the education researchers' theoretical understandings of linguistics and conceptions of multimodality, particularly of its value, productivity, and adequacy for educational translational research (Lim & Tan, 2017).

Third, design-based research is iterative in nature. This involves several rounds of working with the teachers to bring about the change we hope to see. Our project begins with the principle of meeting the teachers at their different points of entry. The first phase of the project involved our visits to the ten teacher-participants' classrooms to observe and understand the way they interpreted and taught multiliteracies. We also interviewed the teachers before the lesson to probe into their beliefs and surface their concerns of the teaching of multiliteracies, as well as after the lesson to hear their reflections on their lesson. The goal

was for us to develop a more nuanced understanding of the teachers' beliefs, pedagogical styles, and the challenges they might face with their classes. In the second phase, we worked closely with six of the ten teacher-participants in the earlier phase to co-design the lesson packages based on what they have earlier taught in Phase 1. The teachers charted their experience through a short-written reflection after each co-design session. The teachers then enacted the lessons and were guided in the reflection of the lessons, and subsequently made another round of refinement to the lesson package together with the research team. The lesson packages were then trialed by 15 other teachers in the schools and refined by the research team in subsequent iterations.

Fourth, a design-based research project is integrative in employing eclectic methods (Riazi et al., 2018) in the research process. The data from our project is drawn from various sources, including lesson observation field notes, video recordings of lessons, interviews with and guided reflections from teachers, focus group discussions and survey responses from students. Anderson and Shattuck (2012)

argue for the value of an integrative approach in design-based research to triangulate observations and mitigate the criticism of subjectivity inherent in design-based studies due to the intimate involvement of the researchers. While many sources of data have been collected, in this paper, the data examined are the teachers' classroom practices, their written reflections after the co-design sessions and their sharing during the post-lesson interviews. The data are analyzed to identify evidence of teacher change, specifically in confidence and competence, in the design and enactment of effective multiliteracies lessons.

Finally, and most importantly, design-based research is contextual in the sense that the outcomes are nuanced by the influence of the participants and the setting of the research. As Wang and Hannafin (2005, p. 11) explain, the research results are closely connected with both the design process through which results are generated and the setting where the research is conducted. This does not mean that the findings cannot be applied to other settings. It could, with an understanding of the school context factored in. What is more crucial in design-based research is the recognition that the teacher's agency, and the learning ecology, including both the students' profile and the classroom environment, are influential in shaping the nature and outcome of the study. Ultimately, the output of the project in the form of learning design principles and lesson packages, are open to dissemination to other schools for adaptation to their contexts, rather than to adopt with fidelity.

In this respect, the findings and outcomes of the research remain practicable, accessible, grounded in the reality of the classroom and adaptive for practice. In light of the characteristics of design-based research described above, we applied the approach in our project to bring about teacher change and build their capacities to teach multiliteracies. While this is not explicit goal of the research project, through the devotion of attention to a core group of teachers in the research project, we also hope that our teacher-participants will grow to serve as change agents in their school as role-model and mentors that can guide other teachers in communities of practice (Wenger, 1998). Wenger et al. (2002, p. 4) explain that communities of practice are "groups of people who share a concern, a set of problems, or passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis". In particular, communities of practice are useful in spreading

tacit knowledge which cannot be transferred merely by artifacts containing the information related to particular innovations (Sharari, et al. 2018). Such tacit knowledge include theoretically informed pedagogical understandings and practical instructional strategies for the teaching of multimodal literacy acquired by the teacher-participants over time.

With its innovation-oriented nature, design-based research approach has been used in a number of studies on the teaching and learning of multiliteracies. For example, Menon (2015) carried out a design-based study to explore and confirm the effectiveness of using multimodal tasks to formatively assess the learning of science content and Zammit (2018) showed how the instructional practices designed to explicitly teach the grammars of multimodal mini-documentaries had enabled students to understand the choices made in the written, visual, gestural and audio mode in a multimodal ensemble. Likewise, to emphasise the need to integrate new literacies into the classroom, Bomer et al. (2010) reported on a design-based inquiry which offered students experiences with three practices intrinsic to new literacies: linking, multimodality, and design, which were undertaken with concrete materials and readily available supplies such as paper, string, markers and boxes. For the cause of educational equity, Kapoyannis (2019) challenged the monolingual and monocultural norms of literacy practices and reported the positive impact that the design-based literacy intervention had in supporting the diverse linguistic and cultural needs of the young Canadian English language learners. In a similar vein, Kim (2017) conducted a design-based study to explore the benefits of using interdisciplinary multimodal modeling activities in developing a participatory learning environment for special needs students in an informal learning context. While reporting the benefits of multiliteracies teaching and learning for student literacy development and social equity in education, these studies have not discussed teachers' professional growth as an outcome of the design-based approach, which the current study aims to address. Given the design-based nature of the research project we have implemented for the teaching and learning of multiliteracies, we highlight the results from the close collaboration between researchers and teachers. In this paper, we are guided by the question of what the practical outcomes from a design-based research project between education researchers and classroom practitioners are.

The Study

Participants

Our design-based research project involved a research team of four faculty members, one full-time research fellow, one full-time research assistant, three collaborators from the Ministry of Education, and one external academic consultant. The first phase of the project was implemented between April to September 2019, with the aim to understand how multiliteracies was being taught and learned, by focusing on the practices in three secondary and two primary schools, engaging two teachers and their classes from each school. Throughout this period, we conducted two classroom observations with each teacher, pre-lesson and post-lesson interviews with the ten teacher-participants, one focus group discussion with six to eight students selected by the teachers from each class, as well as a survey with all student participants. The findings on the perceptions and practices of teachers from the first phase have been published in a report for policy-makers and teachers (Lim et al., 2020). The second phase of the project was implemented from January 2020 to December

2021. The researchers conducted 16 co- design sessions with the six of the ten teacher-participants from the earlier phase. One secondary school, with 2 teachers, had to withdraw due to changes in the staff deployment, one teacher from a secondary school left the profession and another teacher from a primary school was taken ill and was on medical leave for much of Phase 2. As such, Phase 2 involved three teachers from two primary schools (Aspen Primary and Basil Primary, both pseudonyms) and another three teachers from two secondary schools (Dahlia Secondary and Eurya Secondary, also pseudonyms). A total of six lesson packages were developed. The lesson packages were then trialed by 15 other teachers in the schools and refined by the research team in subsequent iterations.

The participants are selected through convenience sampling. All participating schools were publicly funded schools nominated by our collaborators from the Ministry of Education. The schools were considered representative of the average population of public schools in Singapore. The schools were located within public housing estates, in the western, northern, and central part of Singapore. Ethical clearance for the study was obtained from the university's Institutional Review Board. Parental consent was obtained for the students to participate through an information sheet and the teachers also conducted a briefing for the students. The profiles of the teachers are summarized in Table 1.

The teachers' experiences in teaching English language range from 5 to 15 years. All of them have been teaching various year levels in the primary or secondary levels and are familiar with the requirements of the national curriculum based on the Singapore English Language Syllabus 2020 as well as with the profiles of their students. The three secondary classes in this study represent all the three courses of study, with the Express (Ex) students achieving the higher

academic results in the Primary School Leaving Examination compared to the Normal Academic (NA) cohort and the Normal Technical (NT) group. In Singapore, most secondary school offers the 3 courses of study, with the 'Express course' for students who are expected to complete their Singapore-Cambridge General Certificate of Education Ordinary-Level (GCE O-level) certification in four years. 'Normal Academic' classes are undertaken by students who are expected to either complete their four-year Singapore- Cambridge GCE Normal (Academic) Level (GCE N (A)- Level) course and continue to study vocational courses in a polytechnic or continue for a fifth year to complete their O-Levels. 'Normal Technical' classes are for students who are expected to complete a Normal (Technical) 4-year course, then progress to either the fourth year of the GCE N (A)-Level course or study vocational and technical courses.

Phase 1: Data Collection

During Phase 1, the research team observed and video- recorded two multiliteracies lessons from each teacher to gather baseline understanding on the existent practice with multiliteracies. The teachers were asked to choose any two lessons that demonstrated their multiliteracies teaching to share with the research team. Pre- and post-lesson interviews of about 20 min with the teachers were conducted and audio-recorded to probe into the teachers' beliefs about multiliteracies teaching. A focus-group discussion with a group of six students was also conducted with each of the classes to gather the students' feedback on the

lessons to triangulate the data gathered from the teachers. The perceptions of the teachers and students on the teaching and learning of multiliteracies, as well as the classroom practices observed, are reported in Lim, et al. (2020). The findings indicated, amongst others, that teachers used multimodal texts more often as stimulus for reading and writing, and less often for the teaching of critical viewing and effective representing skills. It was also observed that the explicit teaching of viewing and representing were conducted in a few lessons.

Table 1 Teacher participants

Teacher	Class/school	Gender	Years of ELT experience
Basil Pri T1	Primary 4/basil primary	Female	10
Basil Pri T2	Primary 4/basil primary	Female	5
Aspen Pri T1	Primary 5/Aspen. Primary	Female	10
Eurya Sec T1	Secondary 1 (EX)/Eurya secondary	Female	15
Dahlia Sec T1	Secondary 1 (NT)/Dahlia secondary	Female	6
Dahlia Sec T2	Secondary 1 (NA)/Dahlia secondary	Male	8

Phase 2: Lesson Co-designing

After understanding the teachers’ perceptions and practices of multiliteracies teaching, in Phase 2, the participating teachers were offered professional seminars which focused on the theories and practice of multiliteracies teaching, drawing on the works of the New London Group (1996) and Cope and Kalantzis (2015). The researchers worked closely with the teacher participants to design a multiliteracies lesson package with each teacher in the co-design sessions. Specifically, we discussed ways to integrate the teaching of viewing and representing skills into a learning unit identified by the teacher in the year plan. We spent two to four co-design sessions with each teacher, in which the team introduced a pedagogic metalanguage (Lim, et al., 2022c) to guide students in the analysis of multimodal texts. In the lessons and offered examples of lesson resources. The teachers performed the agentive role in deciding what would work best for their students, in their school context, and which teaching technique they would be most comfortable with. After each co-design session, the teachers provided a written reflection on the session. They were encouraged to share their feedback from the co-design sessions, identify what they have learnt and raise further questions. The aim of collecting the teachers’ reflections was twofold. First, it was to inform the research team of the aspects that the teachers would need more support in, and second, the reflections would reveal the progress in their professional growth. By the end of the lesson co-design period, each teacher completed a multiliteracies lesson package, comprising four to six lessons which they implemented in their classes. The researchers observed two lessons from the lesson package taught by each teacher and video-recorded the lessons. We also interviewed the teachers after the lessons and conducted a focus group discussion with four to eight students from each class to explore how the lessons can be improved in their further iteration. Table 2 outlines the contents of the lesson packages completed by the teacher participants.

Data Analysis

Teachers' Competence to Teach Multimodal Literacy

In order to examine the changes in the teachers' practice in relation to their competence to teach multimodal literacy, we examine their discourse during the lesson and compare between the first set of lessons we observed in Phase 1 and the second set of lessons in Phase 2. The video-recorded lessons were first transcribed and then coded according to the Lesson Microgenres (LMG) identified from the teacher discourse during the lesson. The LMG analysis of the lesson is based on Christie's theory of Curriculum Genre () to study the development of a topic in a curriculum. O'Halloran (1996, 2004) extends this to map the development a lesson according to the various stages in a Mathematics classroom. The LMGs are realized multimodally—often with language, but also with other semiotic modes. O'Halloran (1996, p. 65) explains that 'the unfolding of actual texts is displayed dynamically in clause time. In this way, the synoptic description of the microgenres for the analysis of lessons is used to dynamically represent the unfolding of an actual text'. The LMG is also applied to English language classroom (Lim, 2021) and the Lesson Microgenres in an English language lesson on multiliteracies is listed in Appendix 1.

The proportion of curriculum time spent on the different Lesson Microgenres were calculated and represented in bar graphs on the LMG charts. While the LMG chart of a lesson represents all the discourses that occurred in that lesson, in this study, the researchers paid attention to the presence of specific discourses which were identified to be important in a multiliteracies lesson. They are the discourse on content (DOC) and the discourse on multimodal awareness (DMA). While DOC reflects the teacher's focus on the content of the teaching materials, DMA highlights the meaning-making strategies embedded in the different semiotic modes. The followings are examples of teachers' DOC and DMA.

DOC: And look at that, it's a little- there's a little piece of ice there. Can you see how far the polar bear has to swim? (Dahlia Sec T1, Phase 1 lesson 1).

DMA: Did you notice the ways attention is drawn to the little calf here? [teacher makes a "zooming in" action with her hands] (Dahlia Sec T1, Phase 1 lesson 1).

The analysis of the classroom discourse based on the lesson microgenres allows us to have a sense of the types of talk during the lesson. For example, from the lesson microgenre analysis, we can ascertain whether a particular lesson focused sufficiently on multimodal awareness besides the textual content. We then compared the lessons observed during Phase 2 with those in Phase 1, based on the Lesson Microgenre bar charts, for any significant changes to the proportion of different classroom discourses. This was undertaken for pairs of lessons sharing similar objectives and conducted by the same teacher participant.

Teachers' Confidence to Teach Multimodal Literacy

The teachers' reflections from the co-design sessions with the researcher and their post-lesson interviews were examined to identify their growth in confidence to teach multimodal literacy. All the interviews with the teachers were transcribed verbatim and, together with the teachers' written reflections, they were thematically analyzed in two rounds. First, they

were coded based on a predetermined set of codes and then the data underwent inductive coding, in which emergent themes were identified and organized under the big themes. The teachers' interviews in Phase 1 were analyzed in relation to the themes on the teachers' understanding of multiliteracies and their teaching practices. The teachers' interviews in Phase 2 were analyzed

in relation to the themes on the teachers' perceptions of the professional development opportunities offered to them and the teachers' reflections on the multiliteracies lesson implementation.

Table 2 The co-designed lesson packages

Teacher	Lesson topic	Viewing and representing skills incorporated
Basil Pri T1	Instructional text	Viewing skill: unpacking the multimodal meaning of instructional videos, focusing on <i>Gaze, Shot, Angle</i> and <i>Perspective</i> Representing skill: making a short instructional video clip
Basil Pri T2	Picture book	Viewing skill: unpacking the multimodal meaning of picture book, based on <i>Encounter, Engagement</i> and <i>Evaluation</i> framework Representing skill: extending a story with words and illustration
Aspen Pri T1	Narrative text	Viewing skill: unpacking the multimodal meaning of a football video clip, focusing on <i>Perspective, Shot, Angle</i> and <i>Facial expression</i> Representing skill: multimodal planning of a narrative composition, reflecting the <i>perspective</i> of the narrator and <i>facial expressions</i> of the characters
Eurya Sec T1	Visual text	Viewing skill: unpacking the multimodal meaning of a visual text, focusing on <i>Form, Audience, Message</i> and <i>Integration of meaning</i> Representing skill: making a poster
Dahlia Sec T1	Personal recount	Viewing skill: unpacking the multimodal meaning of a short film clip, focusing on <i>Mood</i> and <i>Gesture</i> Representing skill: oral representation of a personal recount, focusing on the use of <i>Mood</i> and <i>Gesture</i>
Dahlia Sec T2	Visual text	Viewing skill: unpacking the multimodal meaning of a visual text, focusing on <i>Form, Audience, Message</i> and <i>Integration of meaning</i> Representing skill: making a poster

Outlines the contents of the lesson packages completed by the teacher participants

Findings

Teachers' Change in Practice: Growth in Competence

One common observation across lessons in Phase 1 was that they had very high proportion of DOC (Discourse on Content) but very low proportion of DMA (Discourse on Multimodal Awareness). In contrast, the proportion of DMA in Phase 2 lessons was much higher across all the teachers' lessons. This suggests that the teachers had moved away from solely discussing the content of multimodal texts and are using pedagogic metalanguage of multimodality to guide students in thinking and talking about multimodal meaning-making in their lessons. The students therefore were explicitly taught not only reading skills but also the viewing and representing skills.

An example of the comparison of the LMG charts for Aspen Pri T1 is presented in Table 3 below. Aspen Pri T1 taught viewing and representing lessons to P5 classes in both Phases 1 and 2. The LMG charts of Aspen Pri T1's viewing lessons from both phases are presented below with the top 5 LMGs in each lesson:

In Phase 1, Aspen Pri T1 used a picture book titled *The Color of Home*. The discussion of the plot and content dominated the lesson, with Discourse on Content taking up 42% of the

lesson time. However, there was also presence of the Discourse on Multimodal Awareness at nearly 21% where students learnt to unpack the illustrations in the book. In Phase 2, as a pre-lesson to the unit on the narrative text, Aspen Pri T1 showed her students a video of the 1986 Brazil versus France World Cup penalty shootout and used examples from the video to introduce the features of shots and perspectives and guide her students to notice details from players' facial expression and body language. The Discourse on Multimodal Awareness replaced the Discourse on Content as the most prominent LMG in the lesson.

In another example, the LMG charts of Eurya Sec T1's lessons on teaching representing in Phases 1 and 2 are compared (Table 4). Comparing Eurya Sec T1's lessons on representing with visual texts from Phase 1 to Phase 2, more time was spent on using the pedagogic metalanguage for visual texts in the latter. As Eurya Sec T1 shared in her post-lesson interview, her teaching of visual texts had become more systematic. The time spent on Discourse on Multimodal Awareness significantly increased from 7.73% in Phase 1 to 24.4% in Phase 2. For example, Eurya Sec T1 used the Discourse on Multimodal Awareness when she modeled how to select and combine different multimodal features to create a visual text as a way to guide her students. Similar observations were obtained from the lessons by other teacher participants, which suggests that the teachers have changed their teaching practices to focus more actively on the teaching of multi-modal awareness.

Table 3 Aspen Pri T1's lessons on teaching viewing

Phase 1 Observation 1 (P5) Viewing of <i>The Colour of Home</i> picture book			Phase 2 Observation 1 (P5) Guided viewing of Brazil vs. France World Cup penalty shootout video		
LMG	Total duration (s)	Proportion of Lesson (%)	LMG	Total duration (s)	Proportion of Lesson (%)
DOC	1682	42.43	DMA	1408	40.02
DMA	830	20.94	DOC	870	24.73
SGW	354	8.93	VS	480	13.64
DR	279	7.04	DI	256	7.28
DI	256	6.46	SGW	219	6.23

Table 4 Eurya Sec T1's lessons on representing

Phase 1 Observation 2 (Sec 1E) Representing task of creating a visual text			Phase 2 Observation 2 (Sec 1E) Representing task of creating a visual text		
LMG	Total duration (s)	Proportion of Lesson (%)	LMG	Total duration (s)	Proportion of Lesson (%)
SGW	1667	41.73	SGW	1786	41.47
DI	468	11.71	DMA	1050	24.38
DOC	445	11.14	DI	536	12.44
DAD	355	8.89	DAD	220	5.11
DMA	309	7.73	DOC	213	4.95

Teachers Change in Perceptions: Growth in Confidence

In Phase 1 of the project, the interview data revealed a sense of the teachers' uncertainty about multiliteracies teaching. Their sharing highlighted their lack of readiness in teaching multiliteracies and also the challenges that they faced in integrating multiliteracies into the EL lessons. This may be due to the fact that though viewing and representing skills had been incorporated in the syllabus since 2010, the term multiliteracies was only introduced for the first time in the EL 2020 syllabus. For the teachers, multiliteracies was a novel concept and they had to figure out how to teach multiliteracies lessons. For example, Basil Pri T1 shared

that *It's something new, it's something fresh, you kind of just figure your way and. trial and test a few things.* Basil Pri T2 also affirmed *[Multiliteracies] is also something new to all of us.* The teachers also expressed their concerns about how to carry out effective multiliteracies lessons. Dahlia Sec T1 raised a practical question of *[How] do we weave the metalanguage and all the different foci [together]?* and added that *[We] are very new to this whole idea.* Similarly, Eurya Sec T1 added that she was *concerned because some concepts can be quite abstract. And (the students) may not be able to see a lot of inferences and the deeper meaning of what the visual texts... trying to express.* The teachers' lack of confidence as revealed in the Phase 1 interviews was not surprising as, given the recent introduction of multiliteracies into the curriculum, many of them would not have been trained to teach multiliteracies.

From the teachers' interviews in Phase 2, all the six teachers reflected that their understanding of multiliteracies had deepened through their participation in the project. They also developed greater confidence in their teaching of multi-literacies. For example, Aspen Pri T2 shared that *Last year, I used the same video as the pre-reading activity, but I think I didn't go so in depth into it. ... This time round, I went more in depth and I used the video in a richer way.* In Phase 1, it was observed that the teachers tend to use multimodal texts such as videos or blogposts as a lead-in activity for language learning without guiding students to unpack the multimodal meaning conveyed in the texts. It was observed that in Phase 2, the teachers started to express the importance of guiding students on how the different semiotic modes can be combined to make meaning. Basil Pri T1 explained that her

mindset and practice had changed in that *... prior to doing this project, my knowledge on multiliteracies was very limited. The opportunity to co-design the 2 lesson packages has greatly deepened my knowledge on the ways to teach multiliteracies in the classroom.* The teachers also appreciated the resources developed from the co-designing process. For example, Basil Pri T1 shared that *the resources provided by [the research team] have also been very useful in meeting the learning objectives. They had helped us to reduce the time needed to prepare resources.* Eurya Sec T1 also added that *the materials provided from [the research team] actually served as a very good guide to how I should go into planning the lessons.*

The teachers were also observed to discuss the tenets of multiliteracies in that it should involve the use of authentic resources and tasks, draw on students' prior knowledge, promote student agency and be appropriately differentiated to cater to different student learning needs. For example, Basil Pri T1 stressed the importance of student agency in that *activities should allow pupils to make choices and reflect on their learning.* This view was also shared by Dahlia Sec T1 in that it was important to put *students' interests first, acknowledging student voice as central to the learning experience.* Other teachers highlighted the importance of engagement with the students' lifeworlds (New London Group, 1996) and explained that *the package needed to be authentic [and] able to provide students with life skills that can be used and applied beyond academic schoolwork* (Basil Pri T2). The goal is to develop students to *have a greater awareness of the various semiotic modes... in their daily communication with others... and become a more discerning reader and effective communicator.* (Aspen Pri T1) The reflections and interview data from the teacher suggest that they have grown in their confidence to design for multimodal literacy learning. They showed a deeper understanding of multiliteracies and were able to highlight the importance of these tenets in their teaching.

Discussion

Our classroom observations, evidenced by the shifts in the Lesson Microgenres of the teachers, as well as the positive reflections from the teachers attest to the teachers' growth and learning through the design-based research approach to their capacity to teach multiliteracies. The shift towards the presence of more Discourse on Multimodal Awareness in the teachers' lessons in Phase 2 is suggestive that the teachers are using the pedagogic metalanguage for multimodality as a resource for teachers and students to think and talk about multimodal meaning-making. This is revealing of the teachers' competencies to guide students in the viewing and representing with multimodal texts as required in the curriculum. The reflections from the teachers also showed a clear contrast across the 2 phases. Towards the end of the design-based research approach, the teacher participants also reported that they have grown through the journey in relation to their beliefs of the value of multiliteracies as well as their knowledge about how to teach multiliteracies. They were able to articulate the tenets of multiliteracies learning and express a greater confidence compared to when they first started.

We met the teachers at their entry point to help them grow in a contextually nuanced and personal manner. In Phase 1, the researchers learnt about the participating teachers' beliefs about multiliteracies and observed how they had been teaching multiliteracies. In the co-design sessions in Phase 2, there was much discussion and negotiation between the researchers and the teachers as we jointly developed the lesson packages. Through working closely with the research team, the teachers grew in their confidence and competence in designing for multimodal literacy learning. Their reflections also indicated a shift in their belief towards the importance in the teaching and learning of viewing and representing.

In the co-design of the lesson packages for multimodal literacy learning with the teachers, we have also distilled design principles, in the form of learning processes. The learning processes in multimodal literacy that we propose are Encountering, Exploring, Evaluating, and Expressing, which is further described in Lim & Tan-Chia (2023), given the constraint of words in this paper. The learning processes build on the dimensions of the Learning by Design Framework (New London Group (1996) which have been developed as knowledge processes in Cope and Kalantzis (2015). Explicating the learning processes for multimodal literacy can inform the development of curriculum requirements, especially in areas of the literacy curriculum such as the knowledge and skills for multimodal literacy learning. The learning processes also guide classroom instruction as the teacher applies them to reflect the ways to bring out the interpretation of the multi-modal text, as well as to support students' multimodal representation of meaning. In the project, we have also applied to guide the design of the lesson packages disseminated as open-access resources from the project. These packages serve as examples of how the learning processes can be applied in the design for multimodal literacy lesson. The project has produced 6 lesson packages and 1 assessment package for teachers from other schools to use and adapt.

The findings from Phase 1 (Lim, et al., 2020) and Phase 2 (Lim, et al., 2022b) have been disseminated in reports for policy-makers at the Singapore Ministry of Education to inform the curricular policy and professional learning support for teachers. We have conducted fifteen invited presentations and workshops for the Ministry of Education and schools in

Singapore. What is encouraging is that the teacher-participants have also gone on to share their learning and lead other teachers in a community of practice as well. For example, Eurya T1 has gone on to lead 5 sessions on multiliteracies learning for teachers in and beyond her school. The design-based research approach involved researchers working very closely with a select group of teachers to grow them to become teacher-leaders and change agents to cascade the new learning to the other teachers in school while the lesson packages provided resources for other teachers to adopt and adapt as fit for their purposes. To sustain practice, teachers can be encouraged to develop communities of practice with a long-term collaborative research agenda (Reeves, 2000) as they innovate and experiment with a repertoire of multiliteracies pedagogies and share lesson ideas and resources as a fraternity.

Conclusion

While curriculum reforms are necessary, they are not sufficient to ensure deep instructional change over time. Teachers' professional development remains key to enacting the curriculum changes (Roschelle & Penuel, 2006). Juuti et al. (2017) highlighted that successful teachers' professional development should be teacher-centered, long-term, contextually situated, collaborative, and with reflective practices. The design-based research approach presents an opportunity for researchers and teachers to come together in collaboration, drawing on the expertise and experience of each party, to improve teaching and learning and fully realize the curriculum reform. Besides, the design-based approach allowed the teachers to develop shared ownership and have ultimate agency over their pedagogical practices, which is crucial as many studies have pointed out that teachers often fail to sustain educational innovations which are designed solely by researchers (e.g. Juuti & Lavonen, 2006; Talbert & McLaughlin, 1999). The experience from our study affirms that the design-based research approach, given its characteristics of being pragmatic, iterative, and contextual, can be productive in bringing about practical outcomes for teaching and learning.

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Appendix 1: Lesson Microgenres

LESSON INITIATION	
Discourse on Greetings (DG)	Polite address by the teacher and students at the start and close of the lesson
Discourse on Attendance (DA)	Teacher checks student attendance for the day
Discourse on Explanation of Events (DEE)	Teacher explains about research and presence of observers
Discourse on Topic Exploration (DTE)	Engage students on the topic of the lesson
Discourse on Lesson Objectives (DLO)	Orientation to the aims of the lesson
Discourse on Administration (DAD)	Operation matters unrelated to teaching and learning
Discourse on Instructions (DI)	Directions to prepare for specific lesson activity
Discourse on Homework Check (DHW)	Teacher checks if students have completed their homework from previous lesson
Discourse on Revision of Previous Lesson (DRPL)	Teacher recaps what was taught in previous lesson
LESSON PROGRESS	
Discourse on Content (DOC)	Teaching of subject knowledge, discussion of content of focal texts
Discourse on General Knowledge (DGK)	Discussion of factual topics, questions
Discourse on Multimodal Awareness (DMA)	Teaching of semiotic modes and/or pedagogic metalanguage for various multimodal texts
Discourse on Genre (DGE)	Teaching on the purpose, form and features of the text
Discourse on Philosophy (DPH)	Discussion of questions that promote critical reflection

Discourse on Language (DOL)	Teaching of grammar and vocabulary
Discourse on Feedback (DF)	Evaluative comments in response to students
Discourse on Reading (DR)	Reading (silently or aloud) of text by teacher or students
Discourse on Skills (DOS)	Teacher goes through answering skills, techniques
Video-Screening (VS)	Use of video
Student Individual Work (SIW)	Students performing assigned task individually
Student Group Work (SGW)	Students performing assigned task in groups
Discourse on Examinations (DEX)	Students taking tests/class assessments
LESSON DIVERSION	
Discourse on Discipline (DD)	Enforcement of expectations and rules for behaviour
Discourse on Time Check (DTC)	Reference to time
Discourse on Permission (DP)	Address of student's request
Discourse on Motivation (DM)	Encouragement of students
Discourse on Rapport-Building (DRB)	Relating with students
Discourse on External Distraction (DED)	Teacher or students are momentarily distracted by something that happens outside the classroom
LESSON CLOSURE	
Discourse on Summary of Learning (DSL)	Summation of key learning points
Discourse on Issuing of Homework (DIH)	Reference to follow-up work from the lesson
Discourse on Plans for Next Lesson (DPL)	Reference to future plans