

Reading, Learning and the Place of School Libraries: Building a Reading Culture in Secondary Schools

Chairperson - LOH Chin Ee, National Institute Of Education, Singapore
Language and Literacy Education

Integrative Summary

There has been greater emphasis worldwide on reading, as reading is perceived as a bootstrap to greater reading ability and learning. The push for reading as a baseline skill is even more urgent in a global economy where higher literacy skills are a guarantee for more employment opportunities and civic participation. The growing anxiety about reading among nations has led to increased concern about reading, and more instrumental approaches to the teaching of reading. Even within Singapore, teachers tend towards functional approaches to language teaching, focusing more on the teaching of intensive reading rather than extensive reading with its emphasis on enjoyment. In schools where extensive reading (also termed Sustained Silent Reading or independent reading) is implemented, they are often influenced by examination-oriented focus that prioritises outcome and skills-based pedagogies (Wolf & Bokhorst-Heng, 2008), and often integrate accountability features that may remove the pleasurable element meant to be part of the extensive reading experience.

The research has on reading has noted the strong correlation between independent reading and academic achievement (Kirsch et al., 2002; Krashen, 2004). An important factor to consider in encouraging independent reading is the element of pleasure (Cremin, 2014; Krashen, 2004), contrary to the tenor of much literacy instruction focusing on practice and more practice. In schools where reading is supported, a community of practice around reading is created (Cremin, 2015; Francois, 2013) and genuine interest in reading is cultivated. Drawing on the research from six case study secondary schools, this panel examines how schools build a reading culture and how the school library can be central to the cultivation of reading in schools. Although Singapore ranked first in the OECD PISA 2015 for reading, it was noted in the report tracing longitudinal test results that while high performing students have improved since the last PISA test, low performers have not improved in their reading performance (OECD, 2016). Drawing on the preliminary findings from the study, this panel discusses how engagement, motivation and pleasure can be central to building a reading culture in schools.

Abstract 1

What Does a Reading School Look Like?

LOH Chin Ee, National Institute Of Education, Singapore

There have been much research demonstrating the correlation between leisure reading (otherwise termed as free, voluntary or extensive reading) and reading achievement (Kirsch et al., 2002). Besides gain in reading comprehension, vocabulary growth, spelling ability, grammatical usage and writing style (Krashen, 2004), students who read well are able to access more texts and knowledge through wide and varied reading (Cunningham & Stanovich, 1998; Neuman & Celano, 2012). However, students with different social backgrounds may have differential access to reading resources and role models (Buckingham, Beaman, & Wheldall, 2014; Neuman & Celano, 2012). How then can the school build a school culture where students want to read, and read widely?

This paper draws on the research data from the six case study schools as well as current research to explain the features of a reading school. Drawing on school-wide reading surveys, interviews with key administrative staff, teachers and students, observations and geosemiotic mapping of place, the paper explains the features of a reading school through the comparative data. Features of a reading school include the following: Providing access to books and reading, ensuring active social lives around books and reading, teachers as role models of reading, learning environments that support reading, reading that is integrated into the school curriculum, and equitable access to reading, particularly to students in need.

Abstract 2

Are Our Students Really Reading and How Do We Know That? Documenting the Effectiveness of Schools' Reading Programmes

Agnes Paculdar, National Institute Of Education, Singapore

Wan Zhong Hao, National Institute Of Education, Singapore
Sun Baoqi, National Institute Of Education, Singapore

As a foundational skill, reading assumes a significant role in learning as well as student achievement. Studies have underscored, for instance, the relationship between voluntary reading and reading achievement (Anderson, Wilson, & Fielding, 1988; Kirsch et al., 2002; Samuels & Wu, 2001). Moreover, students who are inclined towards reading and are able to access knowledge from diverse reading resources likewise obtain knowledge necessary for academic achievement. Studies have also shown, however, that various factors affect students' reading engagement, motivation, skill, and consequently, learning. Among others, these include varying access to reading resources, presence of absence of role models, socio-spatial reading elements, as well as diverse socio-economic backgrounds which tend to contribute to reading gap between students coming from well-resourced families and those who do not. School reading programmes aim to develop better engagement among students toward reading and learning in the midst of the various factors impinging on student reading disposition, habits and practices. However, how do we truly know if our students are really reading and if school reading programmes have achieved some gain towards greater reading engagement among its students? Can we do more than use anecdotal evidence and reading scores to evaluate whether a school is indeed a reading school? This presentation seeks to present some ways to gain more insights into students' reading habits and practices, and what they are reading through the use of both quantitative and qualitative methods of inquiry. Specifically, the usefulness of such instruments such as reading and library user surveys, as well as qualitative observations and visual documentation, shall be presented in greater depth and detail, in obtaining insights into the effectiveness of schools' reading programmes.

Abstract 3

Building a Reading School through the School Library: A Case Study of Commonwealth Secondary School

Mary Ellis, National Institute Of Education, Singapore
Wan Zhong Hao, National Institute Of Education, Singapore
Ng Yui Yun, Commonwealth Secondary School, Singapore

The attention to how educational space and learning are interconnected, particularly with regard to the space of the school library, contributes to much-needed research on educational space and learning in secondary school contexts. Outside of higher educational contexts, there is a dearth of research examining the connection between design of educational space for more effective learning. One exception is the work of Burke & Grosvenor (2008) in the United Kingdom who identified the design element of schools as an important element in promoting learning. In *School*, they argue that "some factors such as the design of school furniture can be seen to reflect pervasive notions of pedagogy, but also to promote ideas and theories about the relationship between pupil and teacher and between body and mind in learning" (p. 10). More recently, a study of libraries as spaces and places of learning by a team of researchers at the Queensland University of Technology attempted to examine how learning spaces and pedagogic practices are interconnected (Bland, Hughes, & Willis, 2013). Their case studies provide detail perspectives of how teachers and students responded to a state-wide initiative of library redesign.

Commonwealth Secondary School, one of the case study schools in this project, renovated its school library in 2016, and completely revamped its approach to text selection and programming in an attempt to inculcate a greater love of learning among its students. This paper examines the school's attempts to build a reading culture through the school library and evaluates the effectiveness of the strategies deployed by the school. Suggestions for utilizing the library for building a reading culture are provided.

Abstract 4

What School Libraries Around the World Are Doing to Encourage Reading

Agnes Paculdar, National Institute Of Education, Singapore
LOH Chin Ee, National Institute Of Education, Singapore

The OECD (2010) report on the PISA 2009 results suggests that the provision of books and educational opportunities can make up for a child's socioeconomic background. The school library plays a central role in cultivating a reading culture (Krashen, 2004) and raising academic achievement (Barratt, 2010; Lance, 2002; Todd & Kuhlthau, 2005). In a series of studies replicated in several states in the United States, including Colorado,

Alaska and Iowa, Lance (2002) concluded that better funded, stocked and staffed school libraries correlate to greater academic achievement. Engaged reading is a precursor to independent learning as skilled readers learn more about language and the world through their reading (Cunningham and Stanovich 1998, Krashen 2004), and the school library can be central to cultivating a culture of reading within the school (Adkins and Brendler 2015), whether in the area of book selection, working with struggling or reluctant readers, planning bridging programmes or engaging students in critical reading. This paper explains the key role of the school library in promoting a reading culture in schools and provides an overview of how reading is supported in school libraries worldwide. Examples of exemplary systems will be shared to demonstrate how governments, schools and the community can work together to encourage a lifelong habit of reading and learning.

Keyword: Literacy, Secondary Schools

AfL as it is perceived and practiced

Chairperson - TAY Hui Yong, National Institute Of Education, Singapore

Discussant - Dr Christopher Deneen, National Institute Of Education, Singapore

Assessment

Integrative Summary

Recent discourse in assessment has highlighted the importance of situating assessment within its context as opposed to adapting a one-size fits all paradigm. In Singapore, with the shift towards more learner-centred assessments that emphasise both the formative and summative, it is more important than ever to understand assessment as it is perceived and practiced in schools within the Singapore educational context. The two papers being presented at this symposium emerge from the pilot phase of a large-scale funded study examining the perceptions and practices related to assessment for learning (AfL). The first paper will present from the perspective of the teachers and school leaders, while the second reflects the students' perspective. Together, they form a school-based case study of AfL practices and suggest the way forward for other schools on this assessment journey.

Abstract 1

AfL through the eyes of the adults...

TAY Hui Yong, National Institute Of Education, Singapore

This paper presents the findings from the pilot phase of a large-scale funded study that examines the perceptions of secondary school leaders and teachers across Singapore in terms of their values, practices and proficiencies on assessment for learning (AfL). Data collection included interviews with teachers and the school leader as well as classroom observations. Results of data analysis found that although teachers and school leaders expressed some similar, general views of assessment, specific, subtle and meaningful differences in conceptualization of AfL emerged. These differences had an observable relationship to teacher assessment and learning practices. Another finding is that AfL processes can happen both within and beyond classroom, despite AfL largely being understood as part of the observable instructional process. The paper will discuss the implications of the findings for research and practice, notably in terms of complex links between AfL perceptions and practices and considerations for locating and observing AfL.

Abstract 2

AfL through the eyes of the students...

Karen Lam, Ministry of Education, Singapore

Drawing on data that are part of the above mentioned large-scale funded study, this paper examines students' perceptions of assessment for learning (AfL) practices enacted by their teachers in the domains of the academic curriculum and co-curricular activities. The data was collected during an hour-long focus group session with six Secondary 3 students as well as analysis of the school's policy documents. The findings from this exploration of students' perceptions of AfL in their school suggest that their experience of their teachers' AfL practices is varied, depending on the subject and teacher. The students' encounter conflicting messages and practices from their teachers' AfL practices. On the one hand, these students value and recognise the importance of assessment in checking for understanding but on the other, their inability to cope with the frequently conducted assessments leads them to feel ambivalent. Data also suggests that assessment has both motivating and demotivating effects on students. The paper concludes by discussing the implication of the findings, particularly in terms of strengthening classroom practice and for the further development of professional dialogues as a means to supporting understanding and competency in AfL.

Keyword: Assessment

Developing and Evaluating an Integrated Instructional Unit on Kinetic Theory of Matter (KTM)

Chairperson - GOH Sao Ee, Academy of Singapore Teachers, Singapore

Discussant - Charles Chew, Academy of Singapore Teachers, Singapore
Science Education

Integrative Summary

KTM is a fundamental scientific concept; the theory undergirds the understanding of particulate behaviours and interactions. Major science reform documents, such as the Next Generation Science Standards (Achieve, 2013), highlight KTM as a core topic area in science understanding. In Singapore, students are elementarily introduced to KTM in lower secondary, and emphasised at upper and post-secondary level.

Our research project relates directly to the teaching and learning of KTM. KTM as a core scientific idea is not well-grasped by students. Broadly, some misconceptions include: (i) particles move in random motion as if such motion is an inherent property of particles (Kind, 2004); (ii) particles seek to diffuse to a region of higher concentration as if they exhibit intentionality in this movement (Fisher, Williams & Lineback, 2011); and (iii) the particles stop moving when they are uniformly distributed in the fluid (Meir et al., 2005). Our experiences as educators also affirm the existence of related misconceptions among students (Goh & Wong, 2012). Some scientists argue that these misconceptions arise as a result of students' limited understanding of the complexity in systems (Chi, 2005; Wilensky & Reisman, 2006).

Our project aims to alleviate this misconception problem by developing an instructional unit that emphasises the complexity of the particle system. This means that students need to understand not only behaviours at the particulate level and the properties and patterns at the system level, but also the interactions among these particles (Wilensky & Resnick, 1999). Bearing in mind the GCE 'O' level science curricular outcomes related to KTM, we developed this novel unit by incorporating complexity ideas and sequencing KTM-related concepts stipulated in the upper secondary biology, chemistry and physics syllabi. We implemented this unit with four Sec 3 classes – about 160 students – over two years. Findings suggested deeper student understanding of KTM-related concepts despite utilising the same amount of instructional time typically allocated.

In this symposium, we first present the complex systems-based instructional framework underpinning this novel unit, and the research findings. Next, teacher-collaborators share their curriculum and implementation experiences before describing persistent student misconceptions they uncovered from this project.

Abstract 1

Complex systems-based instructional unit on KTM: instructional framework and overall findings

GOH Sao Ee, Academy of Singapore Teachers, Singapore

Many scientific systems, including particulate ones, are complex in nature (Yoon, 2011; Jacobson, 2001). What are complex systems? Briefly, a complex system can be defined as an organization of interconnected and interacting components that as a whole, exhibits systemic properties not obvious from those of the individual components (Mitchell, 2009). To understand the complexity in these systems is to be able to reason that the components interact with one another and with their environment in multiple, nonlinear ways, and recognise that the systemic patterns observed emerge from these component-level relationships (Booth-Sweeney & Sterman, 2007).

School science however does not particularly emphasise the complexity in systems (Mitchell, 2009). Rather, science is typically taught in a linear and reductionist approach, focusing on 'breaking down' complex systems to their components for behavioural analysis. This approach simplifies the learning but does not do justice to the multiple interactions among the components that give rise to complex phenomena. Scientists argue that to comprehend such systems, students need to understand their complexity; not only the component behaviours and systemic properties, but also the interactions among the components (Wilensky & Reisman, 2006). Our project aims to alleviate this problem in the teaching and learning of KTM in Singapore upper secondary science by emphasising the complexity of the particulate system.

In this first presentation, we present the design-based approach (Anderson & Shattuck, 2012) in developing and evaluating a complex systems-based instructional framework underpinning this novel unit. Four classes of about 160 students and eight teachers were involved in this trial over two years. We also describe the limitation of predominant instruction of KTM in facilitating student understanding, and the adaptation of existing frameworks (e.g., Levy & Wilensky, 2009; Yoon et al., 2016) for our novel unit.

We share findings which suggested improvement in student understanding of KTM-related concepts ($t=2.8-10.0$, $p<.001$) with moderate effect sizes. In contrast, four quasi-control groups registered growth only for certain concepts with small effect sizes. Teachers implementing the unit also indicated that when KTM was taught in this way, the instruction was more coherent conceptually and students were able to construct a better understanding of KTM.

Abstract 2

Complex systems-based instructional unit on KTM: curriculum and implementation

GOH Sao Ee, Academy of Singapore Teachers, Singapore
Ms Hoh Yi Ting, Presbyterian High School, Singapore
Sujena Sethuram, Presbyterian High School, Singapore
Mr Muhammad Faez Rahmudeen, Presbyterian High School, Singapore
Ms Michelle Goh, Presbyterian High School, Singapore
Mr Wong Yann, Presbyterian High School, Singapore
Mdm Yau Li Heong, Academy of Singapore Teachers, Singapore
Mdm June Wong, Academy of Singapore Teachers, Singapore

In this second presentation, we share the scope and sequence of our novel unit, before focusing on the instructional strategy that we used in helping students construct a more accurate interpretation of KTM. We explain how we customised the unit to align with existing learning outcomes from the GCE 'O' level science syllabi (SEAB, 2015) by integrating the requisite learning outcomes from biology, chemistry and physics into a coherent flow. We also describe how the unit is underpinned by the complex systems-based instructional framework described in the first presentation.

Briefly, the instruction began with the learning of the movement of a single particle before proceeding to interaction of a few and many particles. We wanted to ensure that students acquired an accurate notion that single particles move in constant and straight-line motions until they collide with other particles (or boundary). A computer simulation tool NetLogo (Wilensky, 1999) was used in visualising the movement and interaction. Students were gradually guided in constructing an understanding that systemic properties such as random motion, Brownian motion, diffusion and osmosis simply emerged from the constant motion and multiple interactions among particles.

To guide students in interpreting this complex phenomenon, we used constructivist-based questioning techniques so as to enhance the quality of teacher-student discourse. Questions can stimulate student thinking, provide feedback for the teacher about their understanding and most importantly, help student construct their understanding (Chin, 2007). Such discourse typically is more open-ended, requiring longer responses and elaboration, and the teacher engages the students in self-reflection and elaboration of own responses (Mortimer & Scott, 2003; van Zee & Minstrell, 1997). We employed Mortimer and Scott's (2003) framework to provide an analysis of the conversational patterns in the classroom, so as to demonstrate how the teacher-student discourse has helped students in acquiring a good understanding of the complex particulate phenomenon.

Abstract 3

Complex systems-based instructional unit on KTM: misconceptions

GOH Sao Ee, Academy of Singapore Teachers, Singapore
Mr Chang Jee Yen, Holy Innocents' High School, Singapore
Mrs Cynthia Chan, Holy Innocents' High School, Singapore
Mr Arthur Lim, Holy Innocents' High School, Singapore
LEE Siew Lin, Academy of Singapore Teachers, Singapore

Our research project aims to alleviate misconceptions in KTM by developing an instructional unit which not only

caters to GCE 'O' Levels science syllabi (SEAB, 2015) but also emphasises the complexity of the particle system. This third presentation focuses on what we found about our students' misconceptions, how robust the misconceptions may be, and how we tackle them.

Part of the data collected in this project include student pre- and post-intervention tests on KTM-related concepts, and transcripts of lesson video recordings. We investigated student misconceptions by analysing student responses in the pre- and post-tests and transcripts of teacher-student discourse in class. Several misconceptions were noted. For example, the pre-tests revealed that almost 95% of the students in our eight treatment and control classes possessed an idea of particles moving in constant and random motion even in the absence of other particles. While the intervention managed to clear up some of these misconceptions, there were others that continued to pose difficulties for students to comprehend. For instance, students generally attributed intentionality and concentration gradient as causes for diffusion. We also found that the misconceptions might have arisen due to the way these concepts were explained. For example, in describing Brownian Motion, the visible larger objects such as dust and pollen grains were at times loosely described as 'particles'. This description might not have differentiated these larger objects from the fluid particles surrounding them.

The universality and robustness of these misconceptions among students is not surprising as several researchers have highlighted these in the literature (e.g., Fisher, Williams & Lineback, 2011; Kind, 2004; Meir et al., 2005). Nonetheless, these misconceptions should be addressed because a less-than-accurate scientific understanding of these fundamental concepts can hinder that of more advanced ones. We explain our instructional solution in tackling these misconceptions.

Keyword: Curriculum & Pedagogical Innovation, Science Education

Supporting students' content learning in Mathematics, Economics and Biology through classroom talk

Chairperson - Caroline Ho, English Language Institute of Singapore, Singapore

Discussant - Dennis Kwek, National Institute Of Education, Singapore

Teacher Quality, Teacher Learning and Development

Integrative Summary

This symposium comprises three papers drawing on research from specific subject areas at the pre-university level, namely, Mathematics, Economics and Biology, in collaboration with the English Language Institute of Singapore (ELIS). The studies are contextualised against the support provided for institutions under the Whole School Approach to Effective Communication in English (WSA-EC), a strategic initiative administered by ELIS to develop teachers' ability to communicate subject knowledge effectively to support students' content learning (ELIS, 2011). In the current Singapore and global education landscape, effective communication where students are able to construct, convey and transform information 'coherently, in multimodal ways, for specific purposes, audiences, and contexts' (MOE, 2011) is particularly relevant as one of the core twenty-first century competencies to prepare students for the demands of this century. The three papers build on each other thematically and reinforce each other through a unifying focus in attempting to support students' content learning through using classroom talk meaningfully in various forms for specific purposes. The studies are grounded in sociocultural underpinnings (Bruner, 1983, 1990; Vygotsky, 1978, 1986, 1999) with a focus on the transactional nature of learning where language as a 'symbolic tool' (Walsh, 2013) is used to clarify and make sense of new knowledge through oral communication. The work is centred in the belief that 'in a classroom, it is through language in interaction that we access new knowledge, acquire and develop new skills' (Walsh, 2011, p.2). Of specific interest is how classroom talk and interaction generated through carefully designed learning tasks is used to mediate the content learning process. Teachers' attempts at facilitating active student engagement through carefully structured talk with the use of concrete scaffolds through various modalities and resources to guide and sharpen students' thinking are examined. Recommendations are offered on how teachers can influence content learning through intentional language use and interactional decision-making that facilitate how students think, talk and write in specific content areas.

Abstract 1

Use of visual representations mediated by talk to address literacy demands in Mathematics

YEO Chiu Jin, Temasek Junior College, Singapore

Wong Chiu Min, Temasek Junior College, Singapore

Gan Chin Koon, Temasek Junior College, Singapore

Kevin Ng Yon Tek, Temasek Junior College, Singapore

Joanne Tay Chiew Hsia, Temasek Junior College, Singapore

Lim Chuan Li., Temasek Junior College, Singapore

This study examines how teachers' orchestration of classroom talk to engage students in productive academic discussion (Alexander, 2008) supported by visual representation can enhance students' learning in Mathematics. This is particularly relevant to Mathematics as a subject for which the linguistic, symbolic and visual (O'Halloran, 2005, 2014) representations are critical resources for meaning-making. Of specific interest in this study is the nature of mathematical classroom discourse (Maguire & Neill, 2006) with a focus on teacher-guided discussion with students engaged in constructing their understanding of mathematical concepts related to the topic of permutation and combination. This is targeted at reinforcing the process skills needed for mathematical problem solving, namely, to develop thinking, reasoning, communication skills as stated in the Singapore Mathematics syllabus (CPDD, 2015). Specifically, the ability 'to analyse mathematical situations and construct logical arguments', 'use mathematical language to express mathematical ideas and arguments precisely, concisely and logically', and 'see and make linkages among mathematical ideas' (CPDD, 2015, p. 15) is given attention. This study focuses on teachers' facilitation of the mathematical problem solving process through the use of specific talk moves (Chapin, O'Connor & Anderson, 2013). Strategic questions are crafted based on teachers' anticipation of likely student responses to cognitively demanding mathematical tasks (Stein, Engle, Smith & Hughes, 2008). This is aimed at eliciting from students how a problem is solved and why a particular method is chosen. Students learn to critique their own and their peers' ideas, and seek out appropriate mathematical solutions. Orchestrating meaningful

classroom discussions is targeted at facilitating the scaffolding of students' thinking, enabling students to make the logical links and draw connections in order to deepen conceptual understanding. Data sources include transcripts of recorded lessons with two groups of students of low ability, students' written work, and teachers' and students' perspectives. Teachers' perspectives elicited from focus group discussions and students' written reflections indicate the gains and areas of concern. Pedagogical implications on strategic use of classroom talk supported by visual representations to address the challenges identified and recommendations for future research will be discussed.

Abstract 2

Making Economics thinking visible through productive classroom discussion

LIN Pei, Temasek Junior College, Singapore
Varella Alan Joseph, Temasek Junior College, Singapore
Andy Lim, Temasek Junior College, Singapore
Zeng Wen Jie, Temasek Junior College, Singapore

In Economics, critical and inventive thinking skills are identified as significant for managing the complexities and ambiguities of contemporary economic issues (CPDD, 2016, pg 2). This study examines how these skills leading to the construction of argumentative texts are contextualized under the topics of Resource Allocation and Firms over ten weeks in two classes. Informed by a disciplinary literacy approach (Shanahan & Shanahan, 2008, 2012) with a focus on explicitly teaching the language features and text structure characteristic of the discipline, lessons are designed to scaffold the construction of the argumentative response to a given task. Lessons feature teacher-facilitated group discussions with peer critique of students' work. The approach is grounded in the principles underlying Visible Thinking (Ritchhart, Church & Morrison, 2011) which include the beliefs that development of thinking is a social endeavour with the constant interplay of interaction between the group and the individual, and that fostering thinking requires making thinking visible (Ritchhart & Perkins, 2008). Student engagement in productive academic discussions (Alexander, 2008) is informed by Meyers's (1986) belief in the need for 'cognitive dissonance' (Piaget, 1967, 1980; Festinger, 1957) to challenge students to question the validity of information presented. Structuring the learning tasks and peer interaction to promote critical thinking (Meyers, 1986) is realised through a teacher-facilitated 'Dissect' (where literacy demands of given tasks are unpacked) and 'Design' approach (where students are guided to design appropriate responses using subject-specific language). Two classes of students with different ability levels are involved in the study under the guidance of two teachers over one term. Data sources include video recordings, transcripts, students' written work and assessment performance of control and experimental groups. Teachers' perspectives elicited through reflections highlight personal gains, pedagogic practices that are easily adopted and challenges encountered against on-the-ground constraints. Students' perspectives elicited from focus group discussions and student engagement surveys during and after implementation provide useful insights into the impact of the intervention on students' learning. Pedagogical implications and recommendations for future work are discussed.

Abstract 3

Deepening conceptual understanding in Biology through integrating verbal, visual and textual modes of communication

Joyce TEO, Temasek Junior College, Singapore
Lianya Ho, Temasek Junior College, Singapore
Glendon Phua, Temasek Junior College, Singapore

This paper examines Biology teachers' concrete attempts to enhance students' conceptual understanding of Chemiosmosis in Respiration and Photosynthesis. Specifically, the interest is in mediating the visual with verbal and textual modes of communication (Lemke, 1993, 1994, 1998) for purposeful meaning-making in the construction of scientific texts. Teachers' attempts at making the visualization of the key processes concrete and the necessary links between topics clear through talk moves (Chapin, O'Connor & Anderson, 2013) and visual representations of concept sketches (Johnson & Reynolds, 2005) are examined. The study is grounded in multimodal literacy (Kress & Jewitt, 2003; Kress & van Leeuwen, 2001) underpinnings with the interplay of symbolic representations and verbal language to guide students' thinking and facilitate meaning-making. Research in this field has indicated student gains, particularly in allowing 'students to construct their own concepts and mental framework for complex scientific information' (Johnson & Reynolds, 2005, p.93). This study is aimed at reinforcing 'science inquiry skills in

the use of appropriate models to explain concepts, solve problems and make predictions' (CPDD, 2017, p.4) as stated in the syllabus. Two groups of mixed ability students co-construct knowledge supported by concise annotations of processes, concepts and interrelationships. Through teacher-guided group discussions, opportunities are provided for students to verbalise and deepen understanding of the targeted topic. Students represent their conceptual understanding in concept sketches which include key components of the processes. This exercise enables students to focus on accurate use of scientific terminology. Internalising the processes in novel contexts develops their problem solving skills, a critical component for assessing higher-order thinking skills. This also serves as immediate feedback for the teachers, who can address specific misconceptions to benefit the entire class. Teachers' perspectives drawn from pre- and post- lesson focus group discussions, students' written assessments, and students' feedback on classroom tasks and teachers' practice through surveys administered provide valuable input on the impact on students' learning and the challenges faced by teachers and students. Pedagogical implications and recommendations for classroom integration of integrating visual, verbal and textual modes of communication to support content learning in Biology are discussed.

Keyword: Literacy, Teacher Research

Insights into Research on Singapore Low Progress Classrooms (Part 1)

Chairperson - Imelda S. Caleon, National Institute Of Education, Singapore

Discussant - Robert Santiago de Roock, National Institute Of Education, Singapore
Educational Policies and Practices

Integrative Summary

While Singaporean students are well-known for their exceptionally good performance in international benchmark tests such as TIMSS and PISA, academic achievements are not equal across schools, grade levels, classrooms, and subjects. As educators respond to local policy changes and global shifts emphasising on developing 21st Century learners, it is important to make sure that no child is left behind in the race to maintain and achieve greater academic and non-academic excellence. At the National Institute of Education (NIE), a research task force Children At-Risk (Low Progress Learners) examines educational issues related to children-at-risk of low achievement and low-progress students in Singapore. This group of students include primary school students, students who have been streamed into the lower tracks ("Normal Academic" and "Normal Technical") at the secondary school levels (Grades 7-10), and students who are performing below teachers' expectations or when benchmarked against their peers in the school. The purpose of this symposium is to bring together researchers interested and currently examining issues related to low achievers, low progress learners, Normal track students, and/or students-at-risk. We want to highlight some of the research work, funded by the Office of Education Research at NIE, related to this group of students at the primary and secondary grade levels. In this first of a two-part symposium on Insights into Research on Singapore Low Progress Classrooms, we have three groups of presenters whose work focuses on students' reading abilities. In the first presentation, Caleon and Lopez-Wui will report on quantitative findings from a longitudinal study that examines the complex relationship between teacher-student communication, teacher trust, and teacher alienation with low secondary students' reading achievements. In the second presentation, Tan et al. will discuss the outcomes of a peer-tutoring programme to help primary three students improve their reading comprehension and oral reading fluency skills. In the third presentation that is related to the second presentation, Tan et al. will discuss the outcomes of academic problem solving approach in helping primary four students who were struggling in reading.

Abstract 1

The reciprocal relation between teacher-student relatedness and reading achievement of academically at-risk students

Imelda S. Caleon, National Institute Of Education, Singapore
Ma. Glenda Lopez Wui, University of Houston, undefined

This two-wave panel data aimed to examine the reciprocal relations between teacher-student relatedness (TSR) and reading achievement of academically at-risk secondary students (N=787) in Singapore. In this study, academically at-risk students are those whose aggregates cores were lower than those of their cohort in relation to a national examination that students took at the end of elementary education. Three dimensions of students' reports on TSR were considered: teacher-student communication, teacher trust, and teacher alienation. The collection of TSR and reading achievement data was conducted at two time points: T1 (end of Secondary 1) and then at T2 (end of Secondary 2). The results of cross-lagged analysis involving this two-wave data showed a significant reciprocal yet negative predictive relationship between teacher-student communication and achievement. It was also found that teacher trust and reading achievement in T1 were significant positive predictors of reading achievement in T2. Teacher alienation did not serve as a significant predictor of reading achievement in T2. Implications for research and practice will be presented.

Abstract 2

A Classwide Peer Tutoring Approach to Helping Struggling Readers in Primary Three Classrooms

Tan Chee Soon, National Institute Of Education, Singapore
Lyna, National Institute Of Education, Singapore

Beth O'Brien, National Institute Of Education, Singapore
Rebecca Lee, Pioneer Primary School, Singapore
April Chua, Pioneer Primary School, Singapore

In Singapore, many P3 students in the primary schools struggle with reading and require further assistance to boost their reading ability. The purpose of this study is to improve the reading comprehension and oral reading fluency skills of students with reading difficulties.

A classwide peer tutoring approach known as Peer-Assisted Learning Strategies-Modified (PALS-M) was implemented in six Primary 3 classrooms involving 240 students by six teachers during English Language lessons for one semester. Students in each class were paired, with each pair consisting of a strong reader and a weaker reader. Within each pair, each student served as a reader for part of the time and as a tutor for an equal amount of time. In total, the students received 7 to 9 hour of peer tutoring during the period of the study. As the focus of the study was specifically on the effect of PALS-M on students with reading difficulties, the reading performance of 30 students with reading difficulties was measured before and after the study using the Wechsler Individual Achievement Test – Third Edition. At the end of the study, teachers were interviewed to gain their perspectives on PALS-M. Feedback on the approach was obtained from the students using a survey form.

Data analyses involving the computation of effect sizes using Cohen's *d* indicated that PALS-M had a moderate effect on reading comprehension and a large effect on oral reading fluency. The PALS-M approach was also generally well-received by the students. More than 80% of the 30 struggling readers liked the approach and agreed that peer tutoring helped them to read better and be more confident in reading. Teachers reported that students were engaged during PALS-M lessons and that it benefited both struggling readers and other students in their classes.

Abstract 3

Help Primary 4 Struggling Readers through Academic Problem Solving

Tan Chee Soon, National Institute Of Education, Singapore
Lyna, National Institute Of Education, Singapore
Beth O'Brien, National Institute Of Education, Singapore
Noor Azlin Safari, Yio Chu Kang Primary School, Singapore
Edwin Wan, Yio Chu Kang Primary School, Singapore

Academic problem solving approach involves systematically analysing skill deficits of students in order to design targeted interventions. In this study, academic problem solving was used to identify reading difficulties among struggling readers and to provide interventions to address these difficulties and to improve their self-concept as readers.

Universal screening using curriculum-based measures (CBM) was conducted among all students in one grade level and 30 Primary 4 students with the lowest reading fluency scores were identified. Their reading performance was measured every two weeks using CBM to assess whether they were responding adequately to the classroom instruction in terms of decoding and oral reading fluency skills. Student progress was discussed during fortnightly Professional Learning Committee meetings. Students who demonstrated inadequate response received additional reading instruction targeted to address their specific difficulties. Through the process of academic problem solving, reading interventions were developed, implemented and adapted to address individual pupil's reading difficulty over five months.

The reading performance of the 30 students with reading difficulties was measured before and after the study using the Wechsler Individual Achievement Test – Third Edition. In addition, the Reading Self-Concept Scale (Chapman & Turner, 1995) was administered with these students before and after the study to ascertain whether the interventions had an impact on student perception of their reading ability.

Data analyses involving the computation of effect sizes using Cohen's *d* indicated that the interventions had a large effect on oral reading fluency, a moderate effect on reading comprehension and word reading as well as a small effect on pseudoword decoding. In addition, large effect sizes were obtained on student's perceptions of reading competence and attitude towards reading. The interventions also yielded a moderate effect on students' perception of difficulty with reading.

Keyword: At-Risk Students, Language and Education

Insights into Research on Singapore Low Progress Classrooms (Part 2)

Chairperson - Tang Wee TEO, National Institute Of Education, Singapore

Others

Integrative Summary

While Singaporean students are well-known for their exceptionally good performance in international benchmark tests such as TIMSS and PISA, academic achievements are not equal across schools, grade levels, classrooms, and subjects. As educators respond to local policy changes and global shifts emphasising on developing 21st Century learners, it is important to make sure that no child is left behind in the race to maintain and achieve greater academic and non-academic excellence. At the National Institute of Education (NIE), a research task force Children At-Risk (Low Progress Learners) examines educational issues related to children-at-risk of low achievement and low-progress students in Singapore. This group of students include primary school students, students who have been streamed into the lower tracks ("Normal Academic" and "Normal Technical") at the secondary school levels (Grades 7-10), and students who are performing below teachers' expectations or when benchmarked against their peers in the school. The purpose of this symposium is to highlight some of the research work, funded by the Office of Education Research at NIE, related to this group of students at the primary and secondary grade levels. In this second of a two-part symposium on Insights into Research on Singapore Low Progress Classrooms, we have four groups of presenters whose work focuses on the assessment of low achievers and ways to develop their capacity and their teachers' capacity to teach them. The first two presentations are related to assessment. In the first presentation, de Roock and Trninic will offer an evaluation of international standardised assessments, questioning what the scores actually say about low achievers' abilities. education. In the last presentation, Lim and Wang will describe a new research study that aims to develop secondary school teachers' self-efficacy in managing low-progress students through a teacher professional development programme.

Abstract 1

Disembodied assessment and the problem of defining "low achievers" in Singapore

Robert Santiago de Roock, National Institute Of Education, Singapore

Dragan Trninic, National Institute Of Education, Singapore

In Singapore, high stakes exams like the PSLE (Primary School Leaving Exam) form the principal way that academic achievement is defined, establishing whole segments of a year's cohort of 11 year-olds as low achieving and structurally restricting their life opportunities. Normal Technical (NT) students in particular have limited access to tertiary education and professional career opportunities based on their exam results. Internationally, exams like PISA and TIMSS are a key way of defining who low achieving students are, with significant impacts to educational policy around the globe. Such tests profess to measure the most important academic skills, presumably linked to employability and developing a future workforce, but this claim has been contested on many levels. In Singapore, despite radical differences in PSLE performance, low achieving students perform almost as well as students from other streams in collaborative problem-solving and "non-academic" tasks. They also show a stronger tendency towards some 21st Century Competencies like collaboration. This paper overviews limitations of the local exams and PISA from the vantage point of embodied cognition, a contemporary cognitive sciences perspective. We undertake an analysis of several assessment items from the GCE O Level exams and PISA, discussing to what degree they can be identified as "real world", what they are assessing, and the implications for curriculum and educational policy. In particular, we are concerned with what we perceive to be a gap between what these tests profess to evaluate and what students are actually assessed for.

Abstract 2

An Application of Rasch Measurement in the Understanding of Science Inference Competencies of Lower Track Students in Singapore

Tang Wee TEO, National Institute Of Education, Singapore

Jonathan Goh Wee Pin, National Institute Of Education, Singapore

Khin Maung Aye, National Institute Of Education, Singapore
Yeo Leck Wee, National Institute Of Education, Singapore

The purpose of our study was to investigate how the social and cultural capital of low progress learners, and their mental schema may affect their learning development in making scientific inferences. A total of 1,397 Normal Academic and 638 Normal Technical Grade 7 students from 37 public secondary schools in Singapore participated in the study. Three separate tests were administered to the students over the academic year, and test scores were calibrated and equated using Rasch analysis. The relationship between students' perceptions of science capital and their development in science inference competencies was investigated using Ordinary Least Squares regression analysis. The results indicated that Normal Academic students' views about the importance of science, self-views in science learning, and having classmates who encouraged them to do well in science were significant predictors of their scientific inference competencies. For Normal Technical students, their views about science teachers and views about the nature of science were significant predictors of their performance on making scientific inferences. Further analysis about students' views about the importance of science, views about the nature of science, self-views in science learning, and views about science teachers were discussed along with the implications for science teachers teaching lower track students.

Abstract 3

Developing 21st century Habits of Mind among At-risk Learners through the 6 Learning Structures of Community Music-based Education

Pamela Costes-Onishi, National Institute Of Education, Singapore
Larry Hilarian, National Institute Of Education, Singapore
Isa Dahlan, Si Ling Secondary School, Singapore

Examining the teaching and learning processes inherent in community music is one of the best routes in extracting the kinds of thinking and behavior in the arts that have relevance to 21st century dispositions. Community music learning is largely framed within notions of the informal, collaborative learning, inclusive music making, diversity of musics, intercultural acceptance, ongoing accountability, creativity and lifelong musical learning (Higgins, 2012, p.5). Learning takes place naturally through participation with the instructor serving as facilitator. In this manner, individual creativity is nurtured alongside cooperative learning; whenever formal instruction is present, the role of the teacher as guide remains. Students are given instruction either by rote or a prescriptive notation where individuality of style is nurtured. The big difference is in ownership of knowledge and learning where the participant becomes part of the whole process of his musical experience and education.

In a previous study (OER 01/14 OP), it was hypothesized that when the 6 structures of learning (6LS) in community music is present, certain 21st century dispositions are nurtured in the process. These dispositions are the kinds of behavior and thinking embedded within the learning processes of community music. The 6LS are aural/oral learning, collaborative learning, pattern-based learning, active learning, creative learning, and critical learning. The dispositions nurtured are collaboration, confident person, inquiring minds/discovery, creativity/expressiveness, and global awareness/cross-cultural skills/social awareness. A unique pedagogical approach was then created for implementation to the Normal Academic and Express levels in two secondary schools where the hypothesis was supported to a great extent.

Abstract 4

PD Programme on Teachers' Self-Efficacy in Teaching Low Progress Students

Lim Xue Fang Natalie, National Institute Of Education, Singapore
Wang Li-Yi, National Institute Of Education, Singapore

Teachers' self-efficacy (TSE) is highly influential in affecting teacher quality and educational outcomes. In the authors' previous project (Teacher efficacy in the context of teaching low-achieving students in Singapore, OER 23/12 JW), the authors found that teachers of low progress (LP) students faced the challenge of meeting various cognitive and affective needs of LP students and reported a significantly lower level of self-efficacy in comparison to teachers of high-achieving students (see Wang et al., 2015; Wang et al., In Press). One significant implication of these findings to teacher learning is that impactful professional development (PD) programmes should move towards more specialized trainings on the cognitive, social and psychological needs of LP students and create

more positive experiences that provide constructive sources of efficacy information (SEI) to support teachers develop and maintain a high level of self-efficacy. Following this line, the authors designed a PD programme for enhancing secondary school English teachers' self-efficacy in teaching LP students. The programme consists of three components that create different kinds of positive teaching and learning experiences, providing seven particular SEI for the participants. This study aims to examine the influence of the three components of this PD programme on teachers' self-efficacy and its sustainability. The results will allow the researchers to understand how the three key components of the programme promote (enduring) TSE growth, and thus provide insights into how PD programmes could be developed and implemented to facilitate TSE gains. The results should inform design processes and course evaluation of PD programmes for enhancing TSE in teaching LP students. The results will also be useful from the perspective of PD resources management, helping educational policy makers channel resources to particular aspects/features of PD programmes that have potential to contribute to enduring changes in TSE in this specific teaching context. This paper introduces the design of this programme and discusses its potential in PD and policy development.

Keyword: At-Risk Students

Designing for teamwork

Chairperson - Elizabeth Koh, National Institute Of Education, Singapore

Discussant - Mun Siong KOM, Ministry of Education, Singapore

Learning Sciences

Integrative Summary

Teamwork is often not one of the first concerns among educators and researchers. Educators are often more concerned about the group task, and ensuring that the assignment is completed according to subject requirements. While this is important, meeting academic requirements can go hand in hand with developing students' ability to be effective team members. In other words, academic outcomes can be integrated with the 21st century competency of teamwork. Such integration, however, can be challenging. To what extent should teamwork be designed? Can teamwork happen on its own, i.e., by default? Based on a body of literature, it is increasingly known that successful teams do not just naturally occur. Rather, successful teams consist of members who possess multi-dimensional teamwork competencies. Therefore, a key way to create successful teams is to ensure that students are aware of their teamwork competencies and take specific steps to improve their teamwork processes. Designing such awareness activities and providing teamwork scaffolds can help students become better at working in teams to complete their assignments. Towards this goal, a design-based research project titled, "Integrating My Groupwork Buddy (MGB) Into the Classroom to Enhance Student Team Collaboration and Teacher Pedagogical Practice", was carried out in two secondary schools and co-designed with teachers. In this intervention project, a techno-pedagogical tool, MGB, was developed to help students become more aware of their teamwork competencies and set goals for teamwork improvement. This symposium will bring together the two partner schools and share how each school has integrated MGB into their unique curricular subject for 13 and 14 year olds in 2016. Benefits, enablers and challenges of the implementation will be described. This symposium will be useful for educators interested in designing academic group assignments with the 21st century competency of teamwork.

Abstract 1

The techno-pedagogical development of Project My Groupwork Buddy

Elizabeth Koh, National Institute Of Education, Singapore

Mun Siong KOM, Ministry of Education, Singapore

Jennifer Tan, National Institute Of Education, Singapore

Helen Hong, National Institute Of Education, Singapore

Tee Yi Huan, National Institute Of Education, Singapore

My Groupwork Buddy Project is an intervention to grow students' teamwork competency and enhance the professional practice of teachers in collaborative inquiry projects. In this project, a teamwork competency measure of four dimensions was examined – coordination, mutual performance monitoring, constructive conflict and team emotional support. Through the design-based research methodology, a curriculum that integrates the web-based My Groupwork Buddy, as well as the Team and Self Diagnostic Learning (TSDL; Koh et al., 2016) pedagogical framework, was developed.

This sharing will describe the theoretical and pedagogical underpinnings of the project. It will also show how researchers worked with respective partner schools to develop the intervention. Key learning principles of the intervention will be identified and discussed.

Abstract 2

Enhancing students' teamwork competency through My Groupwork Buddy in iSCoRe2

Tay Kian Leng Patrick, Anglican High School, Singapore

Chan Hwee Leng, Anglican High School, Singapore

iSCoRe2 is a curriculum innovation of the subject Design and Technology in Anglican High School. It provides an authentic platform where students embark on Community problem-solving projects using the Design Thinking

Model. This sharing will look at how My Groupwork Buddy was integrated into iSCoRe2 which enabled students to learn more about their personal teamwork competencies so that they can become more purposeful and effective in their contribution towards a common objective as a team.

The sharing will also explore the different phases where students complete both self and peer reflections and set targets in a bid to assess and review their self and team teamwork competency dimensions. In addition, this sharing will touch on teachers' perspectives on how the use of this portal can help to support teachers' professional competency in teaching and facilitating group activities especially in the design and delivery of group-based collaborative inquiry tasks. Challenges faced in the implementation and integration as well as possible refinements and improvements will also be discussed.

Abstract 3

Integrating My Groupwork Buddy into Project Work

Rebecca Neo Hui Yun, Pasir Ris Secondary School, Singapore
Serene Toh, Pasir Ris Secondary School, Singapore

This sharing aims to provide insights on integrating My Groupwork Buddy into Pasir Ris Secondary School's Integrated Project Work (IPW) programme and how this integration has enabled the students to be more aware of their teamwork competency in the process of completing their group projects. An inquiry-based approach was adopted for IPW whereby students investigate real-world issues and apply what they have learnt in the Geography classroom. In teams, students carried out their Geographical Investigation on the Global Water Shortage in one selected country and explored how this country managed its water resources. As students worked on the projects, My Groupwork Buddy was used to assess the student's teamwork competencies at different stages of the project.

This sharing demonstrates how My Groupwork Buddy enabled students to acquire deeper self-insight on their ability to work as a team member. It also shows the manner in which the use of My Groupwork Buddy helps to give students a basic understanding on how individual team members perceive each other in relation to the four teamwork dimensions. Some challenges faced in integrating My Groupwork Buddy into IPW and possible refinements to the integration of My Groupwork Buddy will be discussed.

Keyword: 21st Century Competencies, Collaboration/Collaborative Learning

Innovation Projects in High School Physics

Chairperson - Joseph HORTEZUELA, Philippine Science High School - Central Visayas Campus, Philippines
Science Education

Integrative Summary

Grade ten junior high school students of Philippine Science High school were tasked to make an innovation or improvisation project out of the first semester topics of the Physics II curriculum of the Philippine Science High School System. Topics of the said innovation must be taken from the topics as: oscillations, waves, sound and light. A proposal paper was required before working on a project requiring them to specify the rationale, related theories, significance, scope, and methodology. The innovation must be beneficial for the community or a low-cost improvisation of an existing device or tool. After the proposal, they were asked to present their output devices or prototypes and explain their findings and results. The following projects are among the best projects chosen from the various projects of the students.

Abstract 1

Echo Ruler

Gregory William Joseph, Philippine Science High School - Central Visayas Campus, Philippines
Danne Allyson, Philippine Science High School - Central Visayas Campus, Philippines
Jeremy, Philippine Science High School - Central Visayas Campus, Philippines

The echo ruler is an innovation that makes use of ultrasonic sound waves to measure distances. This uses echoes, similar to how echolocation is used by bats to learn about their surroundings in pitch black caves, or how ships use sonar to determine the depth of the seabed below them. The echo ruler provides a more practical and cost – effective alternative to using multiple tape measures, especially when the tape measure is stretched too far and its own weight causes it to bend, resulting in some inaccuracies in the measurement. This is practically evident in situations wherein the surface is not flat and it is not easy to measure a straight line. Furthermore, the echo ruler is powered via a USB cord and thus, a common powerbank can be used as energy source. The device is controlled using an Arduino board. It makes use of an ultrasonic sensor which transmits an ultrasonic pulse and waits for an echo. It then measures the time difference and the pre-programmed code on the Arduino board converted the measured time into a distance considering a fixed speed for sound of 343 m/s. The device could measure distances in centimeters with a maximum distance of around 10.0 ± 0.1 m. The findings proved the device to be accurate to within 0.5 centimeters. Considering this, the limitations of the device include changes in the speed of sound due to different factors in the environment such as the number of airborne particles or the humidity. Furthermore the device can only be used to measure distances where air is the medium.

Abstract 2

SAFE (Security Alarm for Everyone)

Jillian Dorothy, Philippine Science High School - Central Visayas Campus, Philippines
Danne Allyson, Philippine Science High School - Central Visayas Campus, Philippines

With the advancement of technology, most of today's modern security systems are reliable enough for a homeowner not to worry about security when getting out of his house. However, these security systems are far out of reach for majority of the people, especially in the Philippines. This project aims to contribute to the people by lessening the cost of a security system compared to the commercial ones. SAFE (Security Alarm for Everyone) is a security system prototype programmed through the use of Arduino and made with a Passive Infrared Sensor (PIR), a light – emitting diode (LED) bul, a piezo buzzer, and a Global System for Mobile Communications (GSM) Module. To create this prototype, the PIR was utilized to detect motion using infrared energy which is given off by humans and animals in the form of heat. A code was then created and implemented in an Arduino kit. Once the PIR is triggered, the program send a signal to the buzzer, LED and GSM module. The buzzer sounds off an alarm, then LED lights up, and the GSM module sends and SMS to the pre-programmed number. It was found that the project was successful, with the PIR having a typical sensing range of around 6 meters or 30 feet and a calibration time of around 20 to 60 seconds.

Abstract 3

TramPiezo: Flex Energy Harvester

Joseph Karl, Philippine Science High School - Central Visayas Campus, Philippines
Bryne Alric, Philippine Science High School - Central Visayas Campus, Philippines
Danne Allyson, Philippine Science High School - Central Visayas Campus, Philippines
Jeremy, Philippine Science High School - Central Visayas Campus, Philippines

Electricity is one of the major needs of this generation. Some of it can be derived from different types of energy such as solar, wind, hydro and geothermal energy. Although these are common methods, they are cost inefficient, and thus alternative sources of energy must be found. The TramPiezo, a contraction of the words trampoline and piezoelectric, is a prototype for alternative energy harvester using trampoline exercise with the implementation of piezoelectric materials. This innovation aims to replace conventional alternative energy sources, along with the benefit of trampoline exercise for the human body. It is composed of five identical energizers, each with 2 piezoelectric disks designed with a rubber mount casing in order to increase the flex of the piezoelectric materials. All 5 energizers are mounted on a 50 cm x 50 cm board, and are all connected to an LED lamp for qualitative functionality. The TramPiezo board is then affixed with four separate spring coils, and is situated under an 85 cm X 85 cm trampoline. Data collection analysis revealed that the TramPiezo can release around 10 – 20 V AC for a single jump, which is more than sufficient for an LED bulb to work.

Abstract 4

Light-up Alarm Device

Danne Allyson, Philippine Science High School - Central Visayas Campus, Philippines

The light-up alarm device prototype aims to help better alert people by using the sound emitted by their regular alarms and generating it into electrical power that activates a light source which can grab the attention of the any person who can see it. This device was made using five resistors, three transistors, one relay, two capacitors, a LED bulb and a recycled microphone speaker. Using these materials, a circuit was created to improvise a light-up alarm device. This was then placed inside a miniature glass house to simulate a building household. It was found out that a sound with an intensity of around 100-dB was needed in order to activate the LED.

Keyword: Science Education, Secondary Schools

Creative Flipped Classroom Learning: An Evidence-Based Framework

Chairperson - Dennis Sale, Singapore Polytechnic, Singapore
Discussant - Cheah Sin Moh, Singapore Polytechnic, Singapore
Curriculum Development

Integrative Summary

The 3 papers of this symposium provide a comprehensive framework for the creative design, facilitating & evaluation of Flipped Classroom Learning. It has evolved from a synthesis of research on what teaching methods work best and the increasing knowledge bases on how humans learn, documented in the book 'Creative Teaching: An Evidence-Based Approach' (Springer, 2015) by one of the presenters.

Over the past 3 years it has been systematically validated through Supported Experiments (Petty, 2009) using quantitative methodology to ascertain student attainment and extensive qualitative work to unpack the student learning experience by employing students as co-participants in the research process.

The first paper 'Flipped Classroom Learning: An Evidence-Based Approach' addresses the present concern that while flipped classroom is widely popularized in the educational literature, it remains "...under-evaluated, under-theorized, and under-researched" (Abeysekera & Dawson, p.3). It provides an evidence-based approach for creative learning design, essential for producing and facilitating high impact flipped classroom learning events, based on the following broad heuristics:

1. Good learning design is always grounded on evidence-based practices and core principles of learning
2. Technology tools are used strategically and creatively to enhance different aspects of the learning process
3. The completed flipped classroom learning design maximizes the affordances of different learning modes and mediums.

The second paper 'Experiments in Evidence-Based Flipped Classroom Learning' documents 'Supported Experiments' (Petty, 2009) in which evidence-based teaching practices (Hattie, 2009) were applied to flipped classroom learning in 2 engineering modules at Singapore Polytechnic. It demonstrates specifically how the approach presented in the first paper resulted in consistent improvements in student attainment for 3 consecutive years in one module and enhanced intrinsic motivation in both experiments.

The final paper, 'Building Professional Capital in Flipped Classroom Learning' focuses on faculty development, showing how a well constituted evidence-based evaluation approach can both frame (and evolve) standards of good practice and the most effective processes for developing what Hargreaves and Fullan (2012) refer to as 'Professional Capital' (e.g., institution-wide faculty competence in using flipped classroom practices at a high level of expertise).

Abstract 1

Flipped Classroom Learning: An Evidence-Based Approach

Dennis Sale, Singapore Polytechnic, Singapore
Cheah Sin Moh, Singapore Polytechnic, Singapore
Mark Wan, Singapore Polytechnic, Singapore

This paper presents a comprehensive evidence-based pedagogical model for designing creative flipped classroom learning experiences. It addresses the present concern that while flipped classroom learning is widely popularized in the educational literature, it remains "...under-evaluated, under-theorized, and under-researched" (Abeysekera & Dawson, p.3). Much of the concern has its roots in the lack of a sound pedagogical model of learning, driving design and facilitated practice. As noted by Picciano, Dziuban and Graham (2014):

...the heavy focus in existing models on physical or surface-level characteristics rather than pedagogical or psychological characteristics is impeding progress. (p.29)

The model presented here evolved from an extensive syntheses of research on what teaching methods work best (Hattie, 2009; Marzano, 2007) and a wide range of knowledge bases relating to human learning. A major component of the model are the Core Principles of Learning, which are scientifically validated cognitive scientific principles that underpin effective learning. The model constitutes a fundamental Pedagogic Literacy (Sale, 2015) for the design and facilitation of learning across all delivery modes. However, when used in a blended learning format (e.g., flipped classroom), it can significantly enhance learning opportunities through leveraging on the affordances of information-communication technologies. This is summarized in terms of the following broad pedagogic heuristics:

1. Good learning design is always grounded on evidence-based practices and core principles of learning
2. Technology tools are used strategically and creatively to enhance different aspects of the learning process
3. The completed flipped classroom learning design maximizes the affordances of different learning modes and mediums.

All key aspects of the model are illustrated with examples, and how this works from an evidence-based approach. In summary, there is now optimism that an evidence-based approach to flipped classroom learning can significantly resolve the concern of it being 'under-theorized'. Instead it will constitute the necessary Pedagogic Literacy underpinning the design and integration of platforms, modes and mediums of learning.

Abstract 2

Experiments in Evidence-Based Flipped Classroom Learning

Cheah Sin Moh, Singapore Polytechnic, Singapore
Mark Wan, Singapore Polytechnic, Singapore
Dennis Sale, Singapore Polytechnic, Singapore

This paper summarizes the approach and outcomes of a flipped classroom teaching innovation using an evidence-based approach (Petty, 2009; Hattie, 2009; Sale, 2015) in 3 modules across the fields of electrical and chemical engineering at Singapore Polytechnic over the past 3-years.

It firstly outlines the rationale for implementing the flipped classroom format and the evidence-based pedagogic approach employed. It then shares, illustrating with specific examples, the full instructional strategy, demonstrating how high effect teaching methods, calibrated to cognitive scientific principles, were combined with appropriate educational technology tools to create highly effective learning experiences for students.

The outcomes of the innovation were evaluated based on 2 areas – (1) the subjective experience of the students in terms of how they felt about the programme and their learning and (2) actual attainment levels in terms of meeting stated outcomes. For the first area, initial data were mainly collected using a typical questionnaire format of Likert-Scale and open response items. However, as the implementation progressed, more extensive qualitative evaluation methods such as using students as 'Co-participants' (Lincoln, 1990) and 'Evidence-Based Reflective Practice' (Sale, 2015) were incorporated. Overall the student feedback showed many positive responses to the flipped classroom format. Students found the provision of short videos interesting and confirmed the learning benefits of the explicit Evidence-Based Teaching strategies employed (e.g. activation of prior knowledge; task and process feedback; the creation of humour and fun as part of the learning experience).

In terms of attainment levels for the electrical engineering module (Digital Electronics), comparison was made between the flipped classes and the entire cohort of students taking the same module, with overall results from both formative and summative assessments throughout the semester. Results showed a consistent improvement in student attainment for 3 consecutive years.

From the 3 years' experience, it is suggested that the flipped classroom format, when underpinned by a strong evidence-based pedagogy, guiding both the learning design and facilitation process as well as the selection and creative use of educational technology tools, can be an effective and efficient format for student learning.

Abstract 3

Building Professional Capital in Flipped Classroom Learning

Dennis Sale, Singapore Polytechnic, Singapore
Cheah Sin Moh, Singapore Polytechnic, Singapore
Mark Wan, Singapore Polytechnic, Singapore

Blended learning is an established part of the educational landscape and there is increasing evidence to suggest that not only is it more efficient and flexible but also more effective than either face-to-face or fully online learning (Means, Toyama, Murphy, Bakia, & Jones, 2010). The Flipped Classroom is a particular format of blended learning which is increasingly popularized in the educational literature but remains, according to Abeysekera & Dawson (2015) "...under-evaluated, under-theorized, and under-researched" (p.3).

This paper outlines an evaluation approach presently being implemented to ascertain the effectiveness and efficiency of flipped classroom learning using Supported Experiments (Petty, 2009) and an evidence-based approach to method selection and use (Hattie, 2009). The methodology, while employing standard quantitative methods for measuring student learning outcomes, places a greater emphasis on qualitative approaches (e.g., grounded theory, phenomenography) for attaining deeper authentic understanding of how students are experiencing the various aspects of flipped classroom learning and their responses to it (e.g., intrinsic motivation, learning strategies, self-efficacy).

A significant part of this methodology involves students in the role of 'Co-participants' (Lincoln 1990) in the research process. These are volunteers who see value in the research purpose and are prepared to commit the necessary time to fulfill role expectations. The student co-participants provide ongoing focused feedback, which enables the researchers to both modify the evaluation focus and the flipped classroom practices, if deemed relevant.

This evaluation approach is being used as a key driver for faculty development in flipped classroom practices, with the overall aim of framing (and evolving) the standards and processes for developing what Hargreaves and Fullan (2012) refer to as 'Professional Capital' (e.g., institution-wide faculty competence in using flipped classroom practices at a high level of expertise).

It has been piloted over the past two years with modules from the fields of electrical and chemical engineering as well as professional development teacher education programmes. Results have been positive in terms of validating the evidence-based practices employed (e.g., advance organizers, task and process feedback, strategies to reduce cognitive load, motivational strategies to create fun in learning).

Keyword: Classroom Research, Critical and Creative Thinking

Are there Evidence-based Pedagogies for Teaching Coding and Computing? If so, what are they?

Chairperson - Prof Looi Chee Kit, National Institute Of Education, Singapore

Discussant - Dr Bimlesh Wadhwa, National University Of Singapore, Singapore
IT in Education

Integrative Summary

We have put together proposals for a symposium and for two workshops all related to computing education. We request for a full-day special strand/track on Computing Education. The track has the overall objective of building understanding the current state of practices in computing education, and of equipping computing teachers with relevant pedagogies for teaching computing.

At the national level, the government is encouraging Computing with the Prime Minister making an impression by sharing his experiences in programming a Sudoku game. The Ministry of Education and IMDA have introduced computing to Primary and Secondary students through the "Code for Fun" enrichment classes where students learn to program in Scratch. Efforts are made to expose students to Computing as early possible and serve as a pipeline for more students to take up computing in their further education, as well as to interest them early in STEM or computing careers.

Teaching Computing requires pedagogies that would be different from conventional approaches such as inquiry or direct instruction. Computing teachers may rely on known teaching approaches in the Mathematics or Science which may not be effective or efficient for students to develop computational thinking skills and programming capacity. Teachers of computing would need a good grounding of computing and pedagogical knowledge, and teaching skills to enact such lessons leading to development of Computing skills in students. Ideally, teachers also need to develop some understanding in the assessment of CT proficiency as well as aptitude and interest of their students so as to guide those students with the right orientations to take steps to advance their educational pathways.

This symposium will bring together speakers who will speak on these topics from different perspectives. They include two school teachers who will share on their experiences teaching the topic, and one NIE and one NUS professor (who have spent much time in outreach coding activities in schools and in community events) who will speak about pedagogies. An additional participant can be a representative from industry or IMDA who will share the industry perspective on computing education needs. A NIE professor will serve as chairperson and facilitator.

Abstract 1

Pedagogical Approaches to Embed Computational Thinking in K-6 Classrooms

Prof Looi Chee Kit, National Institute Of Education, Singapore

The recent focus on computational thinking as an essential skill for all students has led to a number of curriculum initiatives to embed it in K-12 classrooms. In this symposium, we discuss the key computational thinking constructs and discuss how these ideas are related to current educational practices and provide specific means that would allow teachers to embed these ideas in their K-6 classrooms, including recommendations by instructional technologists and professional development experts for embedding computational thinking into other subjects. We aim to outline computational thinking ideas that are essential in making students from just being technology-literate to use computational thinking to solve problems.

Abstract 2

Pedagogical Approaches to Embed Computational Thinking in Secondary School Classrooms

Prof Looi Chee Kit, National Institute Of Education, Singapore

The recent introduction of the new computing syllabus focuses on development of Computational Thinking and programming skills. Students will be introduced to Python as a programming language and required to complete a developmental programming project. The curriculum with the emphasis on developing Computational Thinking and programming skills would require new pedagogical approaches in teaching and learning computing in Secondary schools. In this symposium, we discuss the key computational thinking constructs and discuss how these ideas are related to current educational practices and provide specific means that would allow teachers to embed these ideas in their Secondary school classrooms. We will present different pedagogical approaches in developing learning experiences for students in two Singapore schools that are offering Computing as an O level subject. The purpose of this symposium is to explore the various pedagogies in teaching computing in our Secondary schools and how we can improve student learning of Computing.

Keyword: Critical and Creative Thinking, Curriculum & Pedagogical Innovation

SKIP Classroom Observation Symposium: Describing Pedagogical Practices in Selected Areas of the NEL Framework

Chairperson - SUM Chee Wah, Advisor, Pre-school Education (MOE & ECDA), Singapore
Early Childhood Education

Integrative Summary

In 2014, the Ministry of Education (MOE) funded the 'Singapore Kindergarten Impact Project' (SKIP; OER09/14RB), the first large-scale study on pre-school education in Singapore. The overall goal was to examine how the pre-school environment and pedagogical practices, together with home factors, influenced children's learning and developmental outcomes and predicted their readiness for primary school. The SKIP team recruited 1500 K1 children from 80 pre-schools. The sampling strategy targeted centers from a range of social strata and geographical locations, in order to ensure the generalizability of the findings. A wealth of data has been collected thus far (including a comprehensive battery to assess changes in children's academic and non-academic competencies, questionnaires about the child's home environment and teacher characteristics, and observations to measure classroom quality). It was anticipated that SKIP would have the potential to catalyze quality improvements across the Singapore early childhood education sector, and that the team would embark on subsequent projects to translate and disseminate the findings among the different stakeholders (e.g., teachers, teacher educators, families, policymakers). The present 'SKIP Classroom Observation Symposium' represents one such initiative in the broader programmatic agenda that builds upon SKIP. Drawing on the extensive classroom observation dataset collected by the research team, the overall aim is to describe pedagogical practices in four selected areas of the 'Nurturing Early Learners' (NEL) curriculum framework. The first presentation illustrates exemplary teaching practices in Numeracy, particularly regarding the use of multiple representations for the teaching of new mathematical concepts. The second and third presentations describe the landscape of pedagogical practices in Gross Motor Development and Aesthetics and Creative Expression, respectively, elaborating on the strengths of the teachers observed and suggesting areas for further improvement. The fourth presentation, focused on Discovery of the World, describes existing pedagogical practices related to sustainable development and encourages practitioners to adopt a particular framework to inform the design of sustainability learning activities. This symposium will be highly relevant to early childhood education practitioners, including pre-service and in-service teachers, center leaders, curriculum designers, teacher educators, professional development providers, and early childhood education researchers.

Abstract 1

Multiple Representations in Teaching Preschool Numeracy: An Exemplary Case Study

Raymond ONG, National Institute Of Education, Singapore
Mrs Malikka HABIB, National Institute Of Education, Singapore
Anthony ENG, National Institute Of Education, Singapore
Dr Alfredo BAUTISTA, National Institute Of Education, Singapore

The mathematics education literature shows that children learn mathematics best when new mathematical concepts are introduced using a variety of representational means (e.g., numerical, pictorial, graphical, embodied). Despite evidence suggesting the potential benefits of this pedagogical strategy, research shows that teachers rarely engage children in using multiple representations in a flexible and inter-related manner. While some qualitative studies have illustrated how multiple representations can be used at the primary and secondary school levels, there is a scarcity of research conducted at the preschool level. This qualitative study examines how a preschool teacher (Miss Smith) fostered children's understanding of part-whole concepts using multiple representations. The goal of this case study is to illustrate exemplary teaching practices in the area of Numeracy, one of the learning areas of the 'Nurturing Early Learners' framework. We provide a detailed analysis of the lesson conducted by Miss Smith, in which we identify five exemplary features related to the use of multiple representations: (1) Variety: Miss Smith demonstrates the importance of using several forms of representation to help students answer the question "Who has more?"; (2) Model of Progression: While using multiple representations is essential, this teacher shows that it is further important to introduce them gradually and sequentially; (3) Connections: Emphasis on connection-making between representations is observed when children are encouraged to meaningfully relate the representation being used, rather than considering them in isolation; (4) Encouraging Children's Involvement: Miss Smith mostly uses questioning, scaffolding, and hands-on activities to

get her students involved in the learning of mathematics; and (5) Grouping: In addition to the above-described strategies, small group time is set aside specifically to reinforce the ideas and skills that the children learned in the large group setting. In summary, the lesson conducted by Miss Smith illustrates how multiple representations can be productively used with preschool children, something that is rather uncommon for many teachers due to lack of knowledge or perceived lack of time to cover the required curriculum. Ultimately, our aim is to provide insights that might inspire other preschool teachers teaching numeracy to strategically utilize multiple representations in their lessons.

Abstract 2

Gross Motor Pedagogical Practices in Singapore Preschools: Describing the Landscape

Ms Anisa RAHIM, National Institute Of Education, Singapore
Ms Erin QUEK, National Institute Of Education, Singapore
Ms Poorani V, National Institute Of Education, Singapore
Dr Ana MORENO-NUÑEZ, National Institute Of Education, Singapore
Dr Alfredo BAUTISTA, National Institute Of Education, Singapore

Fostering children's gross motor (GM) development is important in itself and beneficial to the development of numerous cognitive and social skills. Despite this, little is known about how preschool teachers foster the GM development of young children at the classroom level. This study, conducted within the scope of the 'Singapore Kindergarten Impact Project' (SKIP), describes the landscape of GM pedagogical practices in Singapore. The 'Nurturing Early Learners' (NEL) curriculum framework serves as a guide for Singapore preschool teachers to design and implement GM activities. Taking the NEL as a reference, in this study we analyze: (1) The frequency with which Singapore pre-school teachers focus on the various types of GM skills in the classroom; (2) The strengths and weaknesses of teachers' explicit teaching strategies (e.g., providing teaching cues, practice opportunities, feedback provided, practice skills); and (3) The differences between teachers' instructional styles in indoor and outdoor spaces. We created a coding scheme focused on the GM skills and teaching strategies outlined in NEL. Our dataset comprised of 69 episodes of GM lessons across 63 K1 classrooms (note that we had two episodes for six these classrooms); 69 main teachers and 14 assistant teachers were observed. Findings indicate that: (1) Singapore preschool teachers tend to focus on certain GM skills at the expense of others. In particular, running, stretching and balancing were frequently observed among locomotor, non-locomotor, and manipulative skills, respectively. In contrast, other skills such as galloping and kicking were rarely observed. (2) With regard to explicit teaching approaches, we found that providing opportunities for practice is the main strength of teachers, whereas using teaching cues effectively is their main weakness. (3) GM lessons conducted indoors typically display more strategies for explicit teaching than lessons conducted outdoors. We conclude that teachers need support to be able to fully enact the types of GM pedagogical practices outlined in the NEL framework. To ensure that young children are able to achieve the goals established for the GM learning area, professional development initiatives targeted at teachers' needs should be implemented. This study enriches the thin classroom-based international literature on GM education.

Abstract 3

Mapping the Landscape of Art-related Practices in Singapore Preschools

Ms Swee Fuan KOH, National Institute Of Education, Singapore
Ms Farina AMSAH, National Institute Of Education, Singapore
Dr Ana MORENO-NUÑEZ, National Institute Of Education, Singapore
Dr Alfredo BAUTISTA, National Institute Of Education, Singapore

Contemporary early childhood education curriculum frameworks, including the 'Nurturing Early Learners' (NEL), and compelling research studies have increasingly emphasized the importance of arts education in fostering children's holistic development. However, there is limited research focused on documenting how art-related pedagogical practices look like in actual classroom settings. This study, conducted within SKIP, maps the arts education landscape in Singapore preschools. More precisely, we examine: (a) The frequency of the various art forms observed in the classroom; (b) The types of settings in which art-related practices are observed; (c) The availability and accessibility of both art-related activities and materials; and (d) Teachers' instructional strategies. Observations were conducted in 80 preschools (113 K1 classrooms). Drawing on both the international literature and the NEL framework, three independent coding schemes were designed to address (a), (b), and (d). To address

(c), we focused on the items on arts and music from the 'Early Childhood Environment Rating Scale-Revised' (ECERS-R). Quantitative ratings and descriptive statistical measures were used. Findings indicate that in Singapore preschools: (a) Certain art forms are commonly observed (e.g., visual arts 2D, singing, music-and-movement) whereas others are rather rare (e.g., visual arts 3D, dance); (b) The arts appear in four different types of settings, the most common one being integrated learning activities, followed by fillers and transitions, learning center time, and lessons solely focused on the arts. Interestingly, the presence of the various art forms statistically differs in these four settings; (c) Although art activities are frequently available to children, there is limited accessibility to art materials due to the rigidity of schedules; and (d) While classroom climate is generally positive and children seem to enjoy engaging with the arts, teachers tend to be more focused in providing product-oriented instructions rather than in fostering children's individual creativity and expression. Findings indicate that Singapore preschool teachers need support to enact the types of art-related practices outlined in the NEL framework, particularly in relation to certain art forms (e.g., visual arts 3D, dance) and to better foster children's free exploration and access to materials, creativity and self-expression.

Abstract 4

Education for Sustainable Development in Singapore Preschools: The 7Rs as a Pedagogical Framework

Siew Chin NG, National Institute Of Education, Singapore

Dr Alfredo BAUTISTA, National Institute Of Education, Singapore

Dr Ana MORENO-NUÑEZ, National Institute Of Education, Singapore

In recent years, international organizations such as the World Organisation for Early Childhood Education have emphasized the importance of educating young children in Sustainable Development (SD). According to the United Nations (1992), the three codependent pillars of SD are socio-cultural, environmental and economic in nature. Preschool educators have been encouraged to adopt a pedagogical framework known as the 7Rs, a set of attitudes, actions and/or values to be inculcated in children. Based on Engdahl and Rabušicová (2011), these 7Rs include Respect, Reflect and Rethink (which relate to the socio-cultural pillar), Reduce and Reuse (environmental pillar), and Recycle and Redistribute (economic pillar). This study, conducted within the scope of the 'Singapore Kindergarten Impact Project' (SKIP), analyzes the extent to which and the ways in which preschool teachers introduce notions of SD related to the 7Rs framework to children in Singapore. Findings indicate that the presence of SD-related topics in the Singapore preschools is minor. Adopting a case study approach, we qualitatively analyze seven of the eight episodes identified within SKIP's K1 classroom observation database, which showcase Respect (teacher held a discussion about the implications of not respecting nature), Reflect (preferences in eating habits), Rethink (consumption and conservation of natural resources), Reduce (how to save energy and electricity in everyday life), Reuse (how water can be re-used), Recycle (use of recyclable materials to produce art), and Redistribute (donation to aid earthquake victims). Teachers in most episodes exhibited direct teaching approaches, thereby providing information in a prescriptive fashion, as opposed to engaging children in more meaningful discussions or debates about SD issues. The ultimate goal of this presentation is to create awareness among practitioners (teachers, center leaders) of the existence of the 7Rs framework, which may serve as a useful pedagogical tool to inform the design and implementation of learning activities. Our study also shows the need for teachers to address topics related to SD in using more constructivist and dialogical approaches. Finally, this study enriches the thin classroom-based international literature on SD preschool education.

Keyword: Curriculum in Classroom, Early Childhood

The Connected Classroom: An Experiment in Curriculum Innovation

Chairperson - Luis Tirtasanjaya Lioe, Nanyang Girls' High School, Singapore

Discussant - TAY Hui Yong, National Institute Of Education, Singapore

Curriculum Development

Integrative Summary

The Connected Classroom (TCC) aimed at three facets of connections in student learning: 1) deepening understanding of subject matter through inter- and trans-disciplinary connections between and across subjects; 2) connected knowledge through discovery and co-construction of knowledge; and 3) connection between knowledge, self and the real-world.

The success indicators were: 1) Students who are thinkers: curious, questioning, exploring, 2) Students who recognise their role as a learner to be active, engaged, contributing to the community of learners and 3) Students who seek to understand, not only to know: look for connections.

In 2015, incoming Sec 1 students were given the option to be part of a 2-year Lower Secondary TCC curriculum: TCC started with 100 students in three classes, and a team of seven academic subject teachers. The three papers will highlight the different dimension of the implementation.

Abstract 1

System for Connecting the Dots

Sandra Teng, Nanyang Girls' High School, Singapore

Luis Tirtasanjaya Lioe, Nanyang Girls' High School, Singapore

This paper presents the system by which TCC operates in the larger school context: how it involves a team of teachers across disciplines who share the belief and will to realise its goals, the flexibility of deployment, timetabling and infrastructural support, the permission to align assessment to TCC goals, the adoption of the SEI Global Capacities Framework (Choo, Sawch, and Villanueva, 2012) in tandem with the school's Total Curriculum Framework. This paper will also attempt to show some preliminary findings on student outcomes, based on the survey administered at the end of 2015 and two rounds of focused-group discussions in October 2015 and October 2016, and early suggestions for professional learning approaches.

Abstract 2

Connected Units between subjects

Ong Lee Hua, Nanyang Girls' High School, Singapore

Vivien Tok, Nanyang Girls' High School, Singapore

Gloria Teng Sze Ting, Nanyang Girls' High School, Singapore

Mark Shone, Nanyang Girls' High School, Singapore

This presentation attempts to demonstrate what interdisciplinary connection could look like:

1) Contestation for Space -- Early British Singapore: This connected unit explores the relationship between Man and his environment, focusing on the effects of man's activities and behaviour on the physical and living environment of Singapore. Pupils study the early environment of 19th century Singapore and the impact of human activities as the British outpost grew into an important economic settlement. By making connections between Biology, History and Geography, pupils apply what they have learnt in the 19th century case study to a simulated scenario set in modern-day Singapore.

2) Graphing Motion: an exploration into concepts of Kinematics and Linear Graphs from the disciplines of Physics and Mathematics. Students used their knowledge from both disciplines to interpret, analyse and create graphs that described the motion of an object. They worked in teams to create a video of a moving object that reflected the

motion described by the graph.

3) From Kampong to HDB: an exploration into the theme of 'home', more specifically how the historical context, physical and human environments shaped the understanding of what makes a home. The creation of a story map in this unit challenged the pupils to apply historical and geographical skills to document and chart the change and continuity of their family's housing experience.

Abstract 3

Connections to self and the world within subjects

Zhang Rong Hua, Nanyang Girls' High School, Singapore
Sandra Teng, Nanyang Girls' High School, Singapore

This presentation discusses how student learning and total classroom and school experience can be made coherent and cogent with flexibility in how we choose and organise content. The TCC ideals to shift "thinking to learn content" to "more of using content to learn thinking" saw iterations in curriculum and assessment modes in English and Chinese subjects.

Keyword: 21st Century Competencies, Curriculum & Pedagogical Innovation

Culturally Innovative Pedagogies and Value- Relevant Creativity in Early Year Education

Chairperson - Ai-Girl Tan, National Institute Of Education, Singapore
Early Childhood Education

Integrative Summary

In this symposium four papers are presented on experiences of educators and caregivers culturally innovative pedagogies and value-relevant creativity in early year education. The studies reported in the papers uncovered strategies that how preschool teachers and parents co-constructed in the social-cultural environments in an Asian society, Singapore. Since her independence in 1965 Singapore has advocated transformative multiculturalism, nurturing creative imagination, and creating inclusive education for all. In this symposium, using an interview technique Phua and Tan (paper 1) thematic analyzed responses of six preschool teachers and provided some insights into research questions related to their conceptions of play, perceptions of benefits, and experiences of play-based learning of mathematics. With reference to the diary method, Petricia and Tan (paper 2) report on an analysis of daily journal records of a preschool teachers that provide some insights into experiences of a teacher in facilitating "brief brain break sessions" (relaxation and physical exercises) to young children in a preschool setting, and her challenges and perceived benefits in teaching and learning in facilitating different types of "brief brain break sessions" (varying intensity in holistic flow and/or bodily movement) to young children in a preschool setting. Yan and Tan (paper 3) reports a study on preschool teachers' perceptions of creativity and useful pedagogical activities. The findings of 30 preschool teachers uncovered conceptions of creativity that were in line with the cultural-historical theory of creativity and types of creative pedagogies that concurred with age groups of teachers. Amirah and Tan (paper 4) made an inquiry into how special educators and caregivers in Singapore viewed creativity and experienced using culturally innovative methods to nurture inclusive values through nurturing creativity of children with special needs.

Abstract 1

Play-based Learning as a Creative Approach in Teaching Mathematics: An Interview Study with Early Childhood Teachers in Singapore

Karen H. L. Phua, National Institute Of Education, Singapore
Ai-Girl Tan, National Institute Of Education, Singapore

Paper 1

Play-based Learning as a Creative Approach in Teaching Mathematics: An Interview Study with Early Childhood Teachers in Singapore

Karen Phua and Ai-Girl Tan
Nanyang Technological University Singapore

Abstract

Play-based learning is introduced as a creative approach in teaching mathematics following a paradigm shift in the philosophy of early childhood education towards converging cultural and indigenous elements of play for growth and development. Learning a subject matter, mathematics following the play-based Vygotskian approach opens up the cultural space for content delivery and instructional structure. An exploratory study was conducted to answer the research questions: What are preschool teachers' experiences and practices of play-based learning as a culturally innovate pedagogy in the teaching of mathematics? What challenges do they encounter when they implement the play-based innovative pedagogy in the culture of a preschool setting that values integrating play in content-related teaching and learning? Upon the approval of the ethic committee from the university (ECSE/16/ER04), the researcher conducted an interview and collected responses from four kindergarten teachers. The kindergarten in which the participants of the study worked incorporated play-based pedagogies in all teaching and learning. Narrations of the participants of the study were transcribed with reference to Attride-Stirling's inductive approach of the six steps thematic network. The analysis of the data made reference to Saldana's streamlined codes-to-theory model for qualitative inquiry, thereby analyzing and classifying the data into emerging themes through constant comparison analysis and presented through narratives and visuals. Findings revealed a myriad of associated benefits and the feasibility of implementation and assessment of play-based learning in practice. It was suggested that 'unrestrained creativity' might emerge through active engagement of the children as

well as providing the children with 'the opportunity to make mistakes in a non-threatening environment' and 'room to problem solve and communicate with peers and adults'. The study was unable to assess the extent of the success of the teachers' implementation and assessment of play-based lessons due to the lack of observational and pictorial data. Despite the challenges and limitations faced in conducting play-based lessons, the teachers of the study remained optimistic and convinced to integrate play-based learning alongside other creative

Abstract 2

A Study on Experiences in Using Culturally Innovative "Brain Break" Activities with Young Children in the Classroom: A Diary Method

Petrina Shamila, National Institute Of Education, Singapore
Ai-Girl Tan, National Institute Of Education, Singapore

Paper 2

A Study on Experiences in Using Culturally Innovative "Brain Break" Activities with Young Children in the Classroom: A Diary Method
Petrina Shamila and Ai-Girl Tan
Nanyang Technological University Singapore

Abstract

A study was conducted to analyze experiences of a preschool teacher's experiences in using brain breaks as a culturally innovative pedagogy with a classroom preschool children (Karaca, Armağan & Bektaş, 2016). The study was approved by the university (ECSE/16/ER15). Two research questions of the study were formulated: (a)What are experiences of a teacher in facilitating "brief brain break sessions" to young children in a preschool setting? (b)What challenges/benefits in teaching and learning does the teacher face/obtain in facilitating different types of "brief brain break sessions" to young children in a preschool setting? Data collection occurred in 10 daily, 40-minutes English lesson over a period of two weeks from September to October 2016. After completing the day's activity breaks, the teacher immediately documented what happened. These diary entries served as a data source for analysis permitting the researcher to examine the usage of culturally innovative brain breaks and its experiences in their natural, spontaneous (hence creative and relevant) class room contexts. TThe teacher reflective diary for a week were analysed inductively by conducting systematic searching for patterns. Emergent themes included: Classroom management; the types of brain break activities and student enjoyment. The findings indicated that the teacher selected activities for brain breaks based on the criteria of "easy to implement and manage the class" as well as "being well received by children". The findings seem to suggest that brain breaks with culturally innovative elements of physical and relaxing components be the creative-relevant option in terms of regulating the teacher's wellbeing and the students' engagement.

Abstract 3

A Mixed Method Exploratory Study on Preschool Teachers' Perceptions of Culturally Relevant Creativity and Innovative Pedagogies

Chi-Ping Yuen, National Institute Of Education, Singapore
Ai-Girl Tan, National Institute Of Education, Singapore

Paper 3

A Mixed Method Exploratory Study on Preschool Teachers' Perceptions of Culturally Relevant Creativity and Innovative Pedagogies

Yuen Chi Ping
National Institute of Education Singapore

Tan Ai Girl
ECSE AG, National Institute of Education Singapore

Abstract

This paper reports a study on preschool teachers' perceptions of creativity in early years. Three research questions (RQ) were posed: (1) What are preschool teachers' definition of creativity? (2) What factors will teachers consider as important in developing children's creativity? (3) How do these factors relate to teachers' personal and professional attributes? The study was approved by the university (ECSE/16/ER08). A total of 30 preschool teachers in Singapore filled out a questionnaire and answered open-ended questions. The study adopted a mixed method research design. The participants of the study were requested to rate the items on a Likert scale of 1 (totally disagree) and 7 (totally agree) the definitions of creativity developed by the author and her supervisor of the research project. The findings of the response to the questionnaire supported the social-context of creativity in Singapore (Tan, 2000) and the theory of imagination by Polanyi (1978) that when our intention to do something is challenged creativity or imagination occurs, and by the theory of creative imagination by Vygotsky's (2004) that personal and social experiences enrich imagination, a prerequisite of creativity. The responses to the open-questions were positive as the preschool teachers of the study acknowledged that young children were creative and they displayed creativity using different activities.

Abstract 4

Fostering Creativity of Children with Special Needs: Views and Practices of Teachers and Parents

Amirah Zainalabidin , National Institute Of Education, Singapore

Ai-Girl Tan, National Institute Of Education, Singapore

Paper 4

Fostering Creativity of Children with Special Needs: Views and Practices of Teachers and Parents

Amirah Binte Zainalabidin and Ai-Girl Tan

Nanyang Technological University Singapore

Abstract

Following the 2004 the Prime Minister's address on the growing need of Singapore to become an inclusive society and the need for Singaporeans to be inclusive of all citizens – regardless of their abilities (Lee, 2004). Inclusion serves as a value-based transformative force for a change in perceptions and in attitudes towards embracing people with special needs needs. The study was approved by the university (ECSE/16/ER13). This study posed a research question: How do special educators and parents of children with special needs enhance creativity of children with special needs? An exploratory interview study was conducted to find out views and practices of fostering creativity of children with special needs among Singapore's teachers and parents. An interview was conducted with six volunteered participants of which three were parents of children between the ages of seven to 12 with special needs and three were teachers and caregivers of children with special needs who worked children with special needs for at least a year. The age of the participants ranged 23 to 47 years old. In line with the theory of possibility thinking (Craft, 2008), the participants of the study felt that creativity is one way to build up a child's confidence or creativity. These included incorporating activities of interest, use of real life examples, use of various visuals, hands-on activities and sensory materials as well as adopting effective communication methods. The findings of the study suggested further that encouraging children with special needs to develop in their own creative skills, and schools to adopt culturally appropriate pedagogies for children with special needs so that inclusive-values emerge through nurturing creativity amongst children with special needs.

Keywords: Creativity, Inclusivity, Education, Children with Special Needs, Singapore

Keyword: Early Childhood, Special Education

Rethinking Learning Spaces: Teaching and Learning for the 21st Century

Chairperson - LOH Chin Ee, National Institute Of Education, Singapore
Curriculum Development

Integrative Summary

In a globalized market of constant technological advancements and increased competition, the bar for what counts as basic literacy has been raised. At the same time, fearing to fall behind the skills race, nations turn to standardized curriculum, high stakes assessment and best practices to improve students' literacy and learning. More importantly, rather than merely improving students' test scores, 21st century learning should develop students to be critical and creative thinkers who are active citizens in both local and global spaces. This panel presentation moves away from notions of best practices and skills improvement to think about how space can encourage or discourage particular forms of learning. Learning is, after-all, situated within environments (online and offline) where there are rich resources, opportunities for networking and tasks that invite conversation and ignite thinking. First, we explore physical spaces and move to hybrid and online spaces. In the first paper, Loh Chin Ee discusses how the school library can be seen as the invisible node for creating more equitable opportunities for learning, and suggests that deliberate and thoughtful design can revitalize school libraries for greater learning. In the second paper, Michael Tan explores the concept of makerspaces and discusses how we can design spaces that encourage thinking and tinkering. Mark Wilkinson and Mary Ellis move from secondary schools to teacher education in the third and fourth papers to examine how blended learning – where students negotiate online and physical spaces – can enable independent learning and critical thinking.

Abstract 1

Innovating Educational Spaces: How Deliberate Design Can Revitalize Our School Libraries and Learning

LOH Chin Ee, National Institute Of Education, Singapore

In December 2015, Singapore was designated a UNESCO Creative City of Design, and the newly launched Design 2025 Masterplan aims to make design part of everyday living and working. Yet, within Singapore, there has been to date little discussion about how design can influence educational space and learning. The design and organization of educational space convey the dominant ideologies that shape the use of space and can either or constraint the use of space for effective and transformative learning. Ian Grosvenor & Catherine Burke (2008) point out in their historical analysis of school buildings in the Western world that rather than viewing the school building as a “neutral or passive ‘container’”, we should understand it to be an “active agent, shaping the experience of school and promoting and even pioneering a particular understanding of education.

This paper examines how deliberate design of school library spaces can be central to promoting more effective and equitable twenty-first century learning. A review of the literature suggests that twenty-first century school libraries should cultivate dispositions of open-mindedness, critical thinking and creativity, and inquiry through deliberate engagement with curriculum and community. Drawing on extensive research of school libraries in Singapore, including government, independent and international schools, this paper explains how schools can deliberately design reading, research, study, collaboration and “doing” spaces within school libraries. However, good educational design thus needs to take into account teachers' capacity to cope with the change (Leander & Taylor, 2010), and to engage in sustainable innovation at the level of practical use. As such, it is essential to ensure relevant manpower in the form of a trained teacher-librarian to encourage the effective and equitable use of such spaces. Finally, a protocol for evaluating library spaces will be shared.

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Abstract 2

How to makerspace? Design considerations for makerspaces as learning spaces in schools

Michael Tan, National Institute Of Education, Singapore

Making and makerspaces have received much local attention as sites for learners to exercise innovativeness and to learn about rapidly changing STEM technologies. Notably, because of the perceived 'low mess' nature of contemporary digital fabrication, libraries are increasingly being considered for siting makerspaces. In this short paper, I will argue for the makerspace as an interdisciplinary learning space, capturing topical interests and presenting opportunities for schools to provide manipulative, interactive displays that can serve as a cultural nucleation point. Making, as opposed to manufacturing, is an inherently creative act, that enlists not merely the technological elements involved in realising the creative vision, it vitally requires makers to develop a sense of direction and purpose. This necessarily requires a diversity of telos, a desire to want things to be different from what they are. An envisioning of a different future reality may be most often associated with works of science fiction, but as with most fiction, it is not quite the envisioning of a futuristic science and technology that makes the story compelling, but rather how these imagined technologies magnify and bring into sharp relief the quintessential problematics of the human existence. There is a class of problems, termed wicked problems; so-called, not for its evil nature, but its resistance to solution. The method for attempting solutions to wicked problems is, essentially, design; this brings us back again to a renewed sense of purpose for making and makerspaces—it is not quite so much a problem of learning how to use tools to make things, but the bigger prize should be in the enlisting of technology, only when appropriate, to fulfil a diverse vision of what life ought to be. Such a challenge is therefore suitably located within the realm of an interdisciplinary inquiry. The move should be away from a stance of a technocratic solutions-looking-for-problems perspective, to one where technology is wisely applied to carefully chosen problems that require our collective attention. Some design considerations to fulfil such a purpose for makerspaces will be discussed.

Abstract 3

E-Modeling and Cultivating Independent Learners: Negotiating Online and Physical Spaces in a Blended Communications Course for 21st Cen

Mary Ellis, National Institute Of Education, Singapore

The Teacher Education Model for the 21st Century (NIE, 2009) is a seminal planning document for NIE and states that:

"Teachers must be able to support learning environments that enable students to collaborate, share best practices, and integrate 21st century skills into classroom practice. Teachers should also be able to provide access to quality learning tools and resources."

The Communications Skills for Teachers (CST) is a large volume course taken by all NIE students. The course was redeveloped in 2010 to incorporate blended learning. Students are allowed to choose which modules they want to study face-to-face and which ones to study online. This redevelopment corresponded to institutional initiatives such as TE 21 as well as ICT Masterplan 3. Singapore's Ministry of Education has implemented masterplans since 1997 for the use of information communication technology (ICT) into classrooms. Although not overtly a methodology course, the revised CST was seen as a way to model principles such as needs based learning, self-regulated learning and individualization by using a blended mode that integrated a variety of ICT sources. Greener (2009) refers to the importance of e-modelling : " the university teacher who is prepared to role model effectively with technology in the classroom will become an intermediary factor in developing the students self-efficacy" (p. 268). This presentation will trace the development of the CST course and feedback from course developers, tutors and students to examine how students respond to and navigate both physical and online spaces. The role of ICT and the different tools and platforms used and eventual changes to the course will be discussed. Teachers' attitude toward technology will also be considered as it is an important aspect in the effective implementation of blended learning.

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Abstract 4

From the classroom to Haji Lane: Designing a project-learning experience that leverages on multiple

learning spaces

Mark Wilkinson, National Institute Of Education, Singapore

A learning space can be a purpose-designed physical space, such as a classroom, laboratory, or self-access center. It could be virtual, such as a microblogging platform that promotes interaction for learning. To help guide teacher education at NIE, the Institute's Teacher Education Model for the 21st Century (NIE, 2009) states that in looking toward the future of teacher education 'designing technologically rich and co-regulation learning environments ... becomes essential' to 'strengthening instructional differentiation and pedagogical alignment' (p117).

This presentation demonstrates how a blended, project-based language enhancement course is designed to utilise a range of physical and virtual learning spaces. In this course, which helps prepare future primary school teachers to be good role models of standard English, physical spaces and online environments provide the setting for learning experiences that aim to help student teachers refine their knowledge of and skills in using English. This is done through a project in which the learners plan, negotiate, and implement the documentation of an aspect of Singapore's heritage. Learners begin the project in a traditional but IT-facilitated classroom space, moving to an e-learning phase in which the project design utilizes the interactive properties of a microblogging platform to provide learning opportunities. Eventually, the learners move to the natural and built environment of Singapore's streets where they implement and refine their negotiated plan for learning.

The presentation describes a course design in the educational context of Singapore, but this design with its range of learning spaces could equally be applied to other contexts in which teachers aim to plan for or take advantage of learning spaces to enhance their students' learning experiences.

Keyword: 21st Century Competencies, Critical and Creative Thinking

Video-Mediated Professional Development for Music Teachers

Chairperson - Eugene DAIRIANATHAN, National Institute Of Education, Singapore

Discussant - Colleen CONWAY, University of Michigan, United States of America

Teacher Quality, Teacher Learning and Development

Integrative Summary

The use of video in teacher professional development (PD) has exponentially increased in the last two decades, particularly in areas such as mathematics, science, or literacy education. Advocates of video-mediated PD have noted that watching video clips of teaching provides teachers a common context for observing and analyzing instruction, while at the same time preserving the complexity and contextual nature of classroom teaching. Studies have demonstrated that video use supports teacher noticing of salient aspects of practice, including student thinking and interactions between teachers and students. Research has also shown that analysis of video has the potential to support teachers' learning about new instructional strategies. Finally, compelling studies have indicated that teachers are able to apply in their lessons what they have learned through video observation and analysis. This symposium focuses music education, an area where the use of video with PD purposes is a relatively novel approach. The first presentation will introduce the audience to the ongoing project 'Towards Responsive Professional Development for Singapore Music Teachers. Phase 2: Developing Video-Based Learning Resources', in which the National Institute of Education (NIE), the Singapore Teachers' Academy for the aRts (STAR), and Arts Education Branch (AEB) are collaborating to develop a repository of videos targeted at Singapore primary and secondary music teachers. The second presentation will elaborate on Singapore music teachers' own views regarding the roles of peer observation and video-based learning as forms of PD, and regarding how these can be best integrated within the PD initiatives currently available in the local context. Finally, the third presentation reviews the international research literature related to the use of video in music teacher PD, with the final goal of setting up a future agenda for both intervention and research. This symposium will be highly relevant to music educators (including pre-service and in-service teachers), music teacher educators and professional development providers, as well as researchers. The audience will be engaged in a discussion on how videos may be best utilized to further enhance the level of preparation of Singapore's music education teacher fraternity.

Abstract 1

Updates on 'Towards Responsive PD for Singapore Music Teachers. Phase 2: Developing Video-Based Learning Resources'

Dr Alfredo BAUTISTA, National Institute Of Education, Singapore

Siew Ling chua, Singapore Teachers' Academy of the aRts, Singapore

Hui Ping HO, Singapore Teachers' Academy of the aRts, Singapore

Joanne Wong, National Institute Of Education, Singapore

Clarence TAN, National Institute Of Education, Singapore

Sheryl SIM, Singapore Teachers' Academy of the aRts, Singapore

Since its establishment in 2011, the Singapore Teachers' Academy for the aRts (STAR) has collected several hundreds of video recordings related to music teaching and learning (e.g., lessons conducted by music teachers in real classrooms, master teachers demonstrating innovative music activities, music pedagogy workshops). Within the scope of the ongoing MAF project 'Towards Responsive Professional Development for Singapore Music Teachers. Phase 2: Developing Video-Based Learning Resources', we are tapping on this extensive database to create video-based learning resources aimed to foster the professional learning of Singapore primary and secondary music teachers. More specifically, the repositories of coded videos and short video clips currently being developed showcase instances of exemplary music education practices within the Singapore context. In the project proposal, we argued that these video-based learning resources would be highly beneficial to all music teachers (both specialists and non-specialists) as they would allow teachers to improve their pedagogical practices, which would in turn contribute to enhance the musical learning of their students. This presentation has two goals. The first goal, pedagogical in nature, is to introduce the audience to the coding framework that we designed to organize and code STAR's raw video recordings of music lessons. The framework, which draws on the '2015 Syllabus General Music Programme Primary & Secondary' and STAR's student-centric pedagogical principles, constitutes a useful tool for music educators to analyze and reflect upon exemplary classroom practices. It is therefore expected that attendees will benefit from the description of our framework. The second goal is to present some preliminary research findings related to the video editing work completed thus far. In particular, we will provide a descriptive

overview of the short video clips developed within the scope of the project (estimated total = 130 clips), focusing on aspects such as the syllabus content being taught (e.g., Performance, Improvisation and Creation, Listening and Responding) and the pedagogical principles being enacted (e.g., Contextualizing Lessons, Musical Creativity). We claim that this descriptive information can be interpreted as an indicator of Singapore music teachers' current pedagogical strengths. Based on the findings, directions for further improvement will be discussed with the audience.

Abstract 2

Singapore music teachers' views on peer observation as a form of professional development

Joanne Wong, National Institute Of Education, Singapore
Dr Alfredo BAUTISTA, National Institute Of Education, Singapore

Music education research has highlighted the effectiveness of peer observation as a form of teacher professional development (PD). Within the Singapore context, however, we know little about what music teachers themselves think about peer observation and how it could be best integrated within the PD activities in which they participate. To investigate these topics, we conducted semi-structured interviews with 12 music teachers (10 female, 2 male). Participants were diverse concerning music education background, amount of teaching experience, and age. We transcribed the interviews verbatim and used content analysis to analyze the transcripts. The results indicate that peer observation is highly valued by Singapore music teachers, given its direct connection with their classroom practice. Because music is a performative domain that unfolds into action, our participants expressed that observing and imitating others are the most natural learning mechanisms. They appreciate having opportunities to first observe how more experienced music educators implement music lessons in real classrooms, followed by opportunities to try out the observed lessons with their own students. Prior PD experiences based on this approach provided the teachers with new ideas to design and implement lesson, as well as with a better understanding of students' intuitive ideas and common difficulties. Peer observation is perceived to be much more beneficial than, for example, reading new lesson plans or curriculum materials. In fact, our participants expressed that written resources are particularly challenging for teachers with lower music education backgrounds. Despite the numerous benefits of peer observation, our participants described several constraints that have prevented them from consistently engaging in PD that incorporates this method. Among others, they referred to timing issues due to teachers' busy schedules, poor sharing cultures in certain schools, and difficulties to get consent to participate in music-specific PD. Given these constraints, some teachers suggested that having access to video-based peer observation resources would be highly beneficial and convenient (low cost, easy accessibility). We encourage schools, PD providers, and music associations to work towards the creation and dissemination of their own video resources, which will allow teachers to further improve their knowledge, skills, and confidence as music educators.

Abstract 3

Video Use in Music Teacher Professional Development: A Literature Review

Clarence TAN, National Institute Of Education, Singapore
Dr Alfredo BAUTISTA, National Institute Of Education, Singapore
Zachary Walker, National Institute Of Education, Singapore

The use of classroom videos to foster teacher professional development (PD) has been common practice for more than two decades in mathematics, science, and literacy education, areas in which a wealth of video-related research studies have been conducted. In contrast, this widespread use of video is dramatically lower in the field of music education, where research efforts have been sporadic and relatively unsystematic. In this presentation, we review the video-related music-specific teacher PD literature with the final goal of setting up a future research agenda concerning the use of videos in music education. We conducted our literature search in the ERIC and EBSCO databases using an advanced Boolean search for articles containing all the keywords 'video', 'music', and either 'teacher education' or 'professional development'. We excluded irrelevant articles and shortlisted 19 journal articles. After repeated readings and qualitative scrutiny, we established five analytic dimensions: (1) Type of Study; (2) Participants; (3) Content Covered; (4) Actor/s in the Videos; and (5) Activities. Our findings indicate that the video-related music-specific teacher PD literature contains: (1) similar proportions of empirical, theoretical, and policy-related studies; (2) more learning initiatives or experiences targeted at pre-service teachers than in-service teachers; (3) many studies that utilize videos mainly focused on pedagogical topics, in which (4) the actors are the participants themselves conducting lessons in their own classrooms; and (5) many initiatives in which videos are

used as a tool to foster teachers' reflection and collaboration, with the final goal of improving teaching practices—be it through self-reflection, peer review, focus group discussions, or personal sessions with a teacher mentor. We conclude that the use of video in music teacher PD is still in its infancy. We argue that the field needs more intervention studies conducted with in-service music teachers, as well as more experimental research comparing the effectiveness of video-based PD initiatives where teachers undertake different activities (e.g., discussion, analysis, lesson planning), where different types of facilitation are used (e.g., teacher directed vs. facilitator directed), and where participants are exposed to videos with different characteristics (e.g., videos of self vs. others, annotated vs. non-annotated).

Keyword: Arts & Music Education, Teacher Education/Development

Building teaching competence and innovation through research and practice

Chairperson - Edmund Teo, National Institute Of Education, Singapore

Discussant - Dr Jeanne Ho, National Institute Of Education, Singapore

Teacher Quality, Teacher Learning and Development

Integrative Summary

Teachers should engage empirical educational research for knowledge and insights, and engage in educational research to assess the quality and relevance of the knowledge and insights when appropriating them to their practice. This symposium focuses on how teachers engage in research to understand and innovate their teaching practices to address specific practice problems. It highlights the crucial role teachers play in critically examining and intervening in the practice challenges they face. When teachers approach their practice challenges as researchers, they deepen their understanding of how their teaching impacts their students' learning; when they evaluate their experimental interventions, they build professional competence and confidence in their teaching practice. By engaging in research, teachers take ownership of understanding and appropriating research insights into their teaching. They participate in an in-situ continuing professional development that sharpens their professional competence to serve their learners. Three papers will feature in this symposium. The first paper presents the case for teachers to be practitioner-researchers. This is followed with a presentation by two teachers from a Singapore primary school who share their experience learning to use Action Research as a means to sharpen their teaching expertise. The final presentation showcases a zonal approach to advocating the culture of teacher-researcher in schools. The symposium will conclude with a discussion of the opportunities and challenges for teachers engaging in research.

Abstract 1

More than just a Teacher: The case for the Teacher as Practitioner-Researcher

Edmund Teo, National Institute Of Education, Singapore

Teaching, like any profession, requires teachers to ensure that their knowledge and skills are constantly updated and relevant. One way teachers do this is by reading empirical educational research. However, although the volume of empirical research published annually suggests that there is no dearth of research available to teachers, they may not, as passive consumers, necessarily be able to appropriate these research into their practice. To appropriate the research insights into practice, this paper proposes that teachers adopt the role of practitioner-researcher. Empirical research examines and describes the changing educational contexts, providing knowledge and insights into the diverse landscape of learning and complex craft of teaching. By reading the research, teachers remain informed and understand the shifting contexts in which they teach, understand how the dynamic global, national and community contexts influence student learning, and become aware of the various pedagogical approaches and strategies employed by the larger teaching fraternity. These new knowledge and insights are important to the decisions teachers make in their practice. However, while the knowledge generated by empirical educational research may provide general insights and possible answers to problems of practice, they rarely provide useful solutions for the specific contexts in which teaching occurs. To effectively appropriate the evidence for their individual teaching contexts, teachers would have to go beyond passively comprehending empirical research. This paper proposes that the teacher adopts the role of practitioner-researcher and wears two separate yet complementary lenses: that of practice-informed research and research-informed practice. In practice-informed research, teachers draw from their knowledge of existing empirical research to identify and understand the problems faced in their specific teaching contexts for investigation and intervention. In research-informed practice, the results of their investigation and intervention inform the changed practices are finally adopted to address the problems. Through the dual lenses of practice-informed research and research-informed practice, teachers would not just read research but also engage in research to appropriate research insights into practice.

Abstract 2

Teachers in action as researchers

Kok Li Lian, Anglo-Chinese School (Junior), Singapore
Siti Fauziah Abdul Latiff, Anglo-Chinese School (Junior), Singapore

This paper looks at how two teachers of English in lower primary classes collaboratively learn to undertake an action research project to address the problem of students providing inadequate detail in their writing. The teachers identified the problem in English composition writing, where their students tended to write short sentences that lacked detail and elaboration. There was therefore a need to enable students to expand their sentences by writing with greater detail. Drawing from their understanding of schema theory and its application to teaching English in primary classes, the teachers employed action research to critically examine the use of hot-seating, a drama technique, as a pre-writing exercise that enables students to provide more details in their written compositions. They sought to assess the pre-writing activity's efficacy as a solution to the problem. The teachers share their experience of the action research process: the insights into their own teaching practices, the challenges faced, the support provided, the impact on students' learning, and the effect on how they teach.

Abstract 3

Advocating educational research by teachers, for teachers, to teachers – A Zonal Perspective

Varella Alan Joseph, Temasek Junior College, Singapore

In 2005, then Minister for Education, Mr Tharman Shanmugaratnam, announced the setting up of Centres of Excellence for Professional Development across the four school zones in Singapore. These centres serve as focal points for the sharing of best practices to promote a system of continuous professional development, and reflect efforts to help teachers build their capabilities as teaching professionals so that they can better guide their students. In 2007, the Centre of Excellence for Research (CER) was established in one zone to advocate the use of research in teaching practice as a means to enhance teaching and student learning. In addition to housing dedicated facilities and services that support teachers keen on engaging in research to hone their teaching, CER organises various research training sessions and learning symposia for schools to share their research projects. This enabled many teachers to learn how to conduct educational research. Since its inception, CER has published four volumes of research monographs, providing a rich resource of teaching insights from over sixty research projects by teachers in the zone. The monographs not only provide teachers with access to best practices derived from educational research carried out in the zone, they also encourage more teachers to engage in educational research. With almost a decade of experience promoting research among in its schools, CER shares many insights from its journey championing research in teaching practice, tracing the challenges and highpoints from past to present, and how these inform and motivate the centre's mission and plans for the future.

Keyword: Teacher Education/Development, Teacher Knowledge & Cognition

Maker-Centered Learning – A Multi-perspective Experience from Singapore Schools

Chairperson - Koh Hon Jia, National Institute Of Education, Singapore
Curriculum Development

Integrative Summary

Maker-centered learning is widely considered as an emerging approach catalysed by the growing maker culture, communities and spaces worldwide, as well as building upon the learning theories and ideas laid down by eminent thinkers and educators such as John Dewey, Jean Piaget and Seymour Papert, in the form of constructivism and constructionism. In an increasingly uncertain future of the world and dominant rhetoric of fostering economic competitiveness through education, the role of education in cultivating and preparing learners to be an active agent of change for the future is becoming more pertinent. Maker-centered learning, often seen together with anti-consumerism, do-it-yourself mindset, tinkering and technological exploration and competency, has been perceived as a way to cultivate learners for the creative, engineering and technological fields. It is also beginning to be adopted as a viable teaching and learning approach in the 21st century, and are of particular interest to the many education systems, including Singapore. In the midst of the growing expectation and hope of a silver lining offered by maker-centered learning, educators from three different schools in Singapore will share their studies and experiences of introducing maker-centered learning in their schools from multiple perspectives in various settings. The first study examined the affordance of makerspace and importance of maker-culture within a school in supporting a maker-centric Design & Technology curriculum. The study measured the perception of the teachers and students toward creativity and innovation, as well as attitude toward taking actions in identifying and solving problems. The second study examined the impact of iterative experiential learning and rapid prototyping through the design and making process on cultivating maker related dispositional outcome. The third study examined the effects of technology literacy in a maker-centric setting on student engagement and interest in STEM education. Together the three studies examined the maker-centered learning approach using an underlying iterative pedagogical model and the effects on cultivating dispositional outcome, such as creative confidence, and on developing other skillsets and literacies. In summary, a maker-centered learning environment has the potential to empower teachers and students toward cultivating a sense of agency, confidence and competency in learners and makers.

Abstract 1

Of Makers and Spaces

Wee Hong Shen, Ping Yi Secondary School, Singapore
Tan Kok Ping, Ping Yi Secondary School, Singapore
Koh Hon Jia, National Institute Of Education, Singapore
Teo Beng Chong, National Institute Of Education, Singapore

Makerspaces, maker-culture and making are quickly becoming the new buzzwords for creativity, innovation and entrepreneurship in education. Indeed, this has coincided with the growing prevalence of Makerspaces in schools across Singapore's landscape, signaling a growing awareness of the importance of maker-centered and non-academic learning as part of holistic and 21st century education. As one of the many different pathways and models of learning, Makerspaces offer opportunities for students to explore, collaborate and experiment with ideas that go beyond the confines of their textbooks and classrooms.

The advent of accessible and affordable technologies and tools for innovation has catalyzed the growth of Makerspaces. Yet it is important to note that 3D printers and a hodgepodge of tools do not guarantee a successful Makerspace. While Makerspaces serve as a conduit to empowering student-centric and constructivist learning, the design of a maker-centered classroom and learning experience is critical. At its ideological roots, Maker-centered learning can be traced to the constructivism model of learning, where students learn through the process of doing, and making new connections or understanding through reflection of their failures and successes. This implies that the core premise of Makerspace as an educational model hinges on students' dispositions towards exploration and experimentation. Thus, without an underlying culture of risk-taking, imagination and hands-on tinkering within the school environment, local Makerspaces can run the risk of being relegated into costly technological white elephants that achieve little of its potential.

This study will cover two key topics: Firstly, the authors will share their experiences on the implementation of a Maker-centric D&T curriculum, which focuses on the Design Thinking, hands-on activities and iterative experiences

to cultivate positive or creative dispositions toward making as a form of personal interest or learning. Secondly, it will cover the progress of the development of a “maker” culture within the school environment across different levels as a result of the authors’ implementation of their Design and Technology curriculum. The study will measure both teachers’ and students’ perception of their creativity and innovation, as well as their attitude or sense of agency towards taking actions to solve or tackle perceived problems.

Abstract 2

Seeding Innovation and Maker Mindset

Toh Hiew Kang Dennis, Woodlands Ring Secondary School, Singapore
Koh Hon Jia, National Institute Of Education, Singapore
Teo Beng Chong, National Institute Of Education, Singapore

The project aims to cultivate creative confidence and nudge a change from consumer to producer or maker mindset in our students, through empowerment of their learning environment and processes in design, rapid prototyping and social-technological engagement. The concept of creative confidence in this study, which are mainly dispositional in nature such as intentionality or sense of agency, attitude toward uncertainty, learning from failure and persistency, was modified and developed based on Kelly’s model of Creative Confidence (Kelly, 2013). The study investigates the changes in students’ creative confidence and perception towards design and making in Design & Technology classrooms in Singapore. The project develops an approach using the Iterative Nonlinear Pedagogy where the underlying design principles of the learning activities are anchored to authentic experiences in and around students’ communities, and are reinforced and amplified in iterations. Part of this approach can be traced to the constructivist (Piaget, 1976) and constructionist (Papert, 1980) paradigms. The study reports on an investigation into students’ learning experiences of learning through rapid prototyping – both online and face to face (F2F). A combination of open-ended questionnaire and semi-structured interviews was used to investigate students’ conceptions of what they were learning, and their approaches to learning through discussion. Preliminary result suggests that: the students participate more readily and are more engaged in the learning tasks and activities; and the students with a collaborative conception and adopting a deep approach in learning through doing have shown richer conceptions for the design of online and F2F discussion tasks to resolve challenges. The applicability of the maker-centric and iterative approach on other contexts or settings and future extensions will also be discussed in light of the results. In conclusion, there is a need to empower the teachers and students in creating a learning environment towards cultivating active participants, collaboration, making mindset, and creative producers.

Abstract 3

The Use of Arduinos in STEM Education – A Hands-on and Iterative Approach

Leung Hui leng, Raffles Girls' School (Secondary), Singapore
Yeo Puay Hong, Raffles Girls' School (Secondary), Singapore
Koh Hon Jia, National Institute Of Education, Singapore
Teo Beng Chong, National Institute Of Education, Singapore

The advent of technologies such as Arduino microcontrollers has given the man-in-the-street access to tools that were once used exclusively by trained professionals. “Now, almost anyone can innovate. Now almost anyone can make. Now, with the tools available at a makerspace, anyone can change the world” (Hatch, 2014). Hence, the notion of literacy has to be extended to include the use of technology (Leu, 2003) in order for students to participate fully and meaningfully in the world they are living in. The authors designed and implemented a new Design and Technology curriculum to promote technology literacy and creative confidence (Kelly, 2013) in 13-year-old students in an all-girls secondary school through the use of Arduinos and iterative design and making. In order to get students to apply the technology innovatively, students solved problems using the Design Thinking approach (Brown, 2008), in which they used various tools to empathise with the target user, find a suitable problem to solve, solve the problem and demonstrate the solution by using a prototype. Working in teams, students applied these skills and knowledge to solve authentic problems faced in the school canteen, designing and prototyping solutions that were responsive to the context and needs of the user. Students went through the iterative prototyping cycle (Neuva School, 2015), in which they made a prototype, test it and use it to get feedback from the user, and improve the prototype based on the results of the testing and feedback given.

Based on the experience above, and drawing on data collected from a student perception survey, student works, student reflections on learning as well as teacher observations, the authors would share their findings on using arduinos in the new curriculum. Student perception of the curriculum and pedagogy would be discussed, as well as effects on student engagement and interest in STEM (Science, Technology, Engineering and Mathematics). How well the curriculum nurtured creativity and innovation through the Design Thinking approach will be examined through analysing student works. A broad overview of physical and manpower resources needed to implement the curriculum would be shared as well.

Keyword: 21st Century Competencies, Curriculum & Pedagogical Innovation

Educational transfer and pedagogical borrowing: Micro to Macro perspectives from Singapore

Chairperson - Rita Elaine Silver, National Institute Of Education, Singapore
Teacher Quality, Teacher Learning and Development

Integrative Summary

This symposium addresses different ways in which educational practices and policies might be borrowed/transferred across international contexts. The symposium addresses these four questions:

1. What aspects/elements have been borrowed by Singapore or transplanted from other countries, if any? What aspects/elements have been by Singapore or transplanted to other countries, if any?
2. How did the process of borrowing occur?
3. What modifications were applied, if any?
4. What were the effects/impacts/convergences & divergences?

In the first paper, Heng examines teacher perceptions of differentiated instruction, how that is similar/different in the contexts of the US and Singapore, and how those similarities/differences have taken place. In the second paper, Silver presents a teacher professional development project for reading comprehension and discussion in primary level English Language lessons. The paper focuses on how teachers initially and over time understood two linked instructional strategies 'borrowed' from the US. In the third paper, Manzon looks at Singapore as a microcosm of cross-societal and cross-cultural borrowing. She examines the genealogies of Singapore pedagogies and policies and their nestedness in global, national and local discourses. In the fourth paper, De Roock & Espeña move to policy borrowing by discussing PISA as a transnational regime of truth. Specifically their paper addresses discourse of "low" and "high" performing students and educational systems in international media and policy circles and how that discourse has, in term, influenced local educational policies.

The sequencing of papers shows a progression from local to global, micro to macro. Together, the four papers tackle the broader concept of 'borrowing/transfer' in education via teacher perceptions of educational concepts and practices, through international-local-ethnic perceptions of educational 'culture', and through discourses and policies.

Abstract 1

Singapore teachers' perceptions of differentiated instruction

Tang Tang HENG, National Institute Of Education, Singapore

Singapore's educational system is embedded within the global forces of educational borrowing, translation, and benchmarking, and has often looked to other nations for ways to strengthen its curriculum and pedagogy. In response to increasing diversity amongst learners in schools, Singapore educators have been displaying keen interest in differentiated instruction (DI). DI is an approach towards organizing content, teaching and learning that attends to learner variance and has gained prominence via Tomlinson's (2001) work in the United States. Using data collected from surveys, reflection journals, and interviews with educators, this paper examines Singapore educators' perceptions of DI and how their perceptions converge or diverge with that proposed by scholars in the United States. It also seeks to propose reasons for these convergences/divergences and, in doing so, hopes to highlight how local conditions influence educators' perceptions of a curriculum and pedagogical approach borrowed from abroad.

Abstract 2

Teacher Understanding, Borrowed Pedagogies & Teacher Professional Development

Rita Elaine Silver, National Institute Of Education, Singapore
Galyna KOGUT, National Institute Of Education, Singapore

Pedagogical innovations rely on teacher understanding of the innovation: what it is, how it should be done, and ways in which it might effectively be adapted to local conditions. This article describes evolving teacher understanding during a one-year innovation programme. Throughout, teacher understanding, was tracked using a

two-dimensional neo-Bloomian framework. At the same time, emerging teacher concerns were investigated with a ground-up, thematic analysis. Analysis showed that types of teacher understanding aligned with the specific strategies used in the innovation programme to some extent. However, on the whole, teacher understanding showed greater metacognition as the programme progressed. Teacher concerns shifted from the hypothetical (e.g., possible student responses and innovation (in)effectiveness), to concerns about how to further enhance classroom interactions, evidencing another facet of teacher understanding. Finally, initial concerns about cultural appropriateness and borrowing pedagogies from other contexts tended to fade as participating teachers came to their own understandings of how to employ the new instructional strategies.

Abstract 3

Globalization or Nationalization?: Discourses on Educational Borrowing in Singapore

Maria Manzon, The Education University of Hong Kong, Hong Kong

Singapore is an avid borrower of international best practices in education. Or, is it? This paper examines the discourses on educational borrowing in Singapore. It situates this analysis within the comparative education literature on the global politics of educational borrowing and lending (Khamsi, 2004). The genealogies of Singapore pedagogies, concretely in secondary mathematics, and broader education policy initiatives will be explored and analysed in terms of their nestedness in global, national and local discourses. The paper aims to answer the why (politics), how (process) and who (agents of transfer) of educational borrowing seen through the prism of key informants from the government, schools, and academia.

Abstract 4

International media and policy discourses on Singapore's high performance on PISA

Robert Santiago de Roock, National Institute Of Education, Singapore
Darlene Machell de Leon Espena, Nanyang Technological University, Singapore

This paper discusses the transnational media and policy discourses of Singapore's high performance on OECD's Programme for International Student Assessment (PISA). It focuses in particular on the complex ways in which Singapore's educational system is interpreted beyond the nation-state and questions how these cross-cultural borrowings contribute to our understanding of PISA as a material and discursive nexus for ideological construction. More specifically, we ask: How have the media and policy discourses in other countries been directly influenced by Singapore's high performance on PISA and assumptions of an underlying high performing educational system?

Drawing on Foucauldian critical discourse analysis, we undertake an extensive survey of circulating discourses in international media and policy platforms on Singapore's "high performing" educational system. Specifically, we address the discourse of low and high achievement, arguing that the PISA forms a transnational regime of truth (Foucault, 1991). In other words, it tends to homogenize truth, holding sway over views of reality by obscuring other more robust data, research, and lived experiences. Using a transnational perspective, we probe the multiplicity of identification and adoption of Singapore's education system across different countries, focusing on the United States and United Kingdom, and analyze how the processes of interpretation and borrowing take place. A transnational approach provides a critical framework necessary to evaluate these cross-country ideational flows from the local as well as global contexts. Finally, we address related assumptions about the validity of the test for indicating high performing educational system.

We aim to contribute to 1] understanding Singapore educational system's global impact and relevance; 2] implications for educational policies and institutions; 3] theorizing on PISA as a regime of truth and the corresponding ideological assumptions that it perpetuates; 4] examining the foundational discourses of "low/high performance" in PISA testing with an eye toward understanding implications for students across the globe.

Keyword: Professional Development, Teacher Education/Development

Exploring Preschool Inclusion in Singapore: Considering Trends, Practices and Research in the Case of an Inclusive Kindergarten

Chairperson - Wong Meng Ee, National Institute Of Education, Singapore

Discussant - Ai-Girl Tan, National Institute Of Education, Singapore

Special Needs Education

Integrative Summary

Since Singapore's ratification of the United Nation Convention on the Rights of Person's with Disabilities in 2013, greater evidence of provision of support for persons with disabilities is observed. One recent development is the endorsement of compulsory education for students with disabilities. Another is the commitment towards greater inclusion. This is aligned with international trends. The policy and practice of including children with special educational needs has increasingly been to place the children in mainstream schools. As more opportunities become available along the educational continuum, there is value to begin the inclusion effort early in a child's development. Preschool providers share the view to include children with disabilities and their peers who are typically developing. Some benefits include raising the awareness of other children's needs, increased comfort amongst people with disabilities and greater acceptance of differences. In general, children learn to be more responsive and helpful to other children and to have less prejudice and fewer stereotypes about people who look and behave differently. For children with disabilities, inclusion helps them become members of a larger group and benefit from peers and role models (Odom, et al., 2004; Rafferty & Griffin, 2005; Seery, Davis, & Johnson, 2000). This symposium draws from a beginning study to understand the practice of inclusive education from KindleGarden, a preschool with inclusive philosophy and practice. Three papers will be featured in this symposium. The first paper will consider the history and current state of support for children with disabilities in preschool in Singapore. The second paper will introduce the history, background, philosophy and practice of KindleGarden. The third paper will introduce the research framework and intended approach to study the stakeholders involved in the process of inclusion. Collectively, the papers highlight trends, practice and suggestions for initiating partnerships, managing stakeholder expectations and improved inclusive preschool education for the future.

Abstract 1

Inclusive Education in the Preschool Setting in Singapore: An Overview

Joanna Tay-Lim, National Institute Of Education, Singapore

In 2004, the Singapore government issued Singapore's strongest call for inclusion as an integral societal value which its citizens can imbibe as part of the nation's new vision. It can be regarded as the watershed year for inclusive education in Singapore as it birthed an awareness in the Singapore education system that the shaping of an inclusive society has to start with our young when they are still in school. This has profound implications for the preschool landscape here in Singapore. It has been argued that early education at its best is inclusive education. The early childhood years have been regarded as critical for children's development. In addition, there is the view that early childhood education is 'inclusive' by default. This stems from the fact that the majority of regular preschool settings regardless of whether they adopt inclusive practices or not do have children with special needs in their enrolment. This is a highly probable scenario because at this younger age, many of them may not have been formally diagnosed yet. The preschool years are therefore excellent time for children to learn inclusive values and to develop inclusive dispositions. However, unlike mainstream schools in Singapore which have been nationalised and have received more coordinated efforts from the government to launch and develop inclusive practices, the early childhood education landscape consists of a plethora of settings ranging from government and community-based settings to private international preschools. Efforts and advocacy for inclusive practices has therefore come from diverse quarters. This presentation will trace and appraise these diverse efforts and provide a mapping of the journey towards inclusive practices in the Singapore preschool sector. The aim is to provide an overview of how the Singapore preschool setting has thus far responded to the call to embrace inclusive education, and to outline critical considerations in moving forward.

Abstract 2

History, Philosophy and Inclusive Practices in Kindle Garden – Preschool by AWWA

Dr. Honey Ng, AWWA, Singapore
Juliet Tanuwira, AWWA, Singapore

As Singapore matures as a nation, there is a greater awareness, recognition and drive for inclusion. At the same time, however, evidence points to an existing disconnection from amongst our children. Where only 25% of parents reported that their child were friends with children with special needs, lack of conducive opportunities for interaction was cited as a contributing barrier (Lien Foundation, n.d.). This presentation introduces the history of Kindie Garden, its philosophy and practices to foster greater inclusion from the early years. In 2015, AWWA and Lien Foundation launched the first inclusive preschool in Singapore - Kindie Garden (KG). KG sets out to embrace diversity in their practices. Beginning at enrolment, all children regardless of their developmental needs, race, religion and socioeconomic status are welcomed. As each child is recognized for being unique, individual learning is customized with personal Portfolios through termly evaluation and review of their development. Partnership is also fostered with families and communities. To better provide support with special needs, KG teachers collaborate with a team of Early Interventionist, Occupational Therapist, Speech Therapist and Psychologist. Marrying early childhood practices with specialized early intervention knowledge allows for the preschool experience to be holistic and promotes inclusion. Collaboration with families not only includes parent-teacher conferences, workshops and field trips, but parents are also actively engaged to conduct activities during festivals. A defining feature of KG's philosophy is its intention to be inclusive. Access to resources and encouragement of participation is one structural effort. The playground is equipped with wheelchair accessible features. For children with low vision or with tactile needs, textured floor tiles are also available. To cultivate class participation, lesson materials are modified and assistive devices adopted for greater accessibility. The above mentioned are some explicit practices. The presentation will share the journey thus far and looks ahead into how preschool inclusion can be further embraced as Singapore continues to transform itself into inclusive society.

Abstract 3

Exploring inclusion in an inclusive kindergarten in Singapore: Using the "Index on Inclusion" as a framework.

Wong Meng Ee, National Institute Of Education, Singapore
Joanna Tay-Lim, National Institute Of Education, Singapore
Dr. Honey Ng, AWWA, Singapore
Juliet Tanuwira, AWWA, Singapore

This presentation examines the Index on Inclusion as a framework for investigating inclusive provision in a kindergarten in Singapore. The index is a set of materials to support schools in a process of developing inclusive school practices. The concept involves using a set of questions to facilitate the processes to be followed by a school in setting up an inclusive environment (Booth & Ainscow, 2011). In the climate of greater awareness and call for inclusive practices in Singapore, The research was undertaken to better understand how inclusion is embraced in a kindergarten with explicit intent to be inclusive. The presentation will introduce the Index on Inclusion, explore the structure and describes how it was adopted as a complementary feature of a qualitative designed study to research the various stakeholders including parents, teachers, administrators and the children as to how they perceive inclusion from their respective contexts.

Keyword: Early Childhood, Special Education

Teaching Students with autism spectrum disorder in Hong Kong

Chairperson - Fuk-chuen HO, The Education University of Hong Kong, Hong Kong
Special Needs Education

Integrative Summary

In this symposium studies are presented on the identification of the diverse features of students with autism spectrum disorder (ASD), and the delivery of remedial programmes for students with special educational needs. As the good teacher is a significant factor in improving the chances for success for all students, there was a need for efficient training for all teachers who work with students having ASD. It is of our interest to design professional development programmes for teachers by using video and case studies as the instructional strategies. In addition, a collaborative mode of training was also tried out in a professional development programme for teachers of students with ASD.

Abstract 1

Development of a measure on evaluating critical features of children with autism spectrum disorder

Sam Ka-lam LAM, The Education University of Hong Kong, Hong Kong
Fuk-chuen HO, The Education University of Hong Kong, Hong Kong
Cici Sze-ching LAM, The Education University of Hong Kong, Hong Kong
Grace Chan, The Education University of Hong Kong, Hong Kong

Current research indicated that the situation of lacking established quantitative assessment tools for children with autism is mutual, especially in Hong Kong Chinese context. The objective of this study was to develop an instrument for catering the preliminary need. The process of scale development consisted two phases. Phase 1: literature review, expert group consultation, and focus group interview of the current stakeholders, so as to gather ideas and draft correspondent items. Phase 2: the drafted scale was administered to 19 schools (primary school = 9; secondary school = 2; special school = 8). A hundred of ninety-six children, age ranged from 6 to 14, were involved. Data analysis: Factor structure and internal consistency of the scale were investigated. Four corresponding subscales were identified, which included: self-control and regulation, effective communication, intention anticipation, readiness of unexpected change, and behavioural & emotional management in classroom. The overall model was generally justified by the fit statistics (5-factor model: CFI = .585; RMSEA = .098). Given the trend of evidence-based practice, the recent scale can be utilized for initial screening, to spot out individual needs, as well as evaluate the effect of a particular intervention for children with autism.

Abstract 2

Training programme for students with special educational needs

Grace Chan, The Education University of Hong Kong, Hong Kong
Ka-yan TSE, The Education University of Hong Kong, Hong Kong
Cici Sze-ching LAM, The Education University of Hong Kong, Hong Kong
Chi-hung LEUNG, The Education University of Hong Kong, Hong Kong

The remedial programmes aim at enhancing the social and communicative skills of students with autism spectrum disorder (ASD) as well as those with attention deficit and hyperactivity disorder (ADHD). Two kinds of remedial programmes were organised for students with ASD and those with ADHD in ordinary schools. Each programme consists of 10 one-hour training sessions. Theory of Mind (ToM) and executive functioning are the major instructional approaches for the programme for students with ASD and that for students with ADHD respectively. Most students were able to follow the instruction and gain significant improvement in their social and communicative skills during the training period. However, the remedial programmes were delivered in a pull-out mode. Whether the learned skills could be transited to the ordinary class environment was a major concern in these programmes.

Abstract 3

Using videos and case studies in a professional special education teacher training course: A Hong Kong experience

Cici Sze-ching LAM, The Education University of Hong Kong, Hong Kong

Fuk-chuen HO, The Education University of Hong Kong, Hong Kong

Professional Special Education training in Hong Kong is usually arranged in the lecture format. Furthermore, the provision of such courses for in-service teachers were often limited by the short duration of time. Videos, therefore, show the powerfulness to create learning experience in individual lessons for teacher training, as well as showing how the videos, combined with case studies, to complement the entire course as well as the practicum. Individual interviews were conducted to understand the process of the whole process of video learning. By applying the concept of scaffolding, the influence of videos and case studies on teaching and learning comes from the articulation of the participants, as well as the summative assessments. It is hoped that this article will inform the practitioners or teacher educators who would like to use videos and case studies to help teachers in understanding the needs of students with special needs.

Abstract 4

Collaborative mode of professional development, and teachers of Students with Autism Spectrum Disorder (ASD)

Fuk-chuen HO, The Education University of Hong Kong, Hong Kong

Cici Sze-ching LAM, The Education University of Hong Kong, Hong Kong

Sam Ka-lam LAM, The Education University of Hong Kong, Hong Kong

Ming-tak HUE, The Education University of Hong Kong, Hong Kong

The present study aims to deliver a school-based mode of training for in-service teachers of students with autism spectrum disorder (ASD) in Hong Kong. The delivery of the training follows the phases of exploration, installation and implementation. The project team uses the approach of Theory of Mind (ToM) to teach students with ASD the recognition of and the reaction to emotions. A school cluster system was set up, with the goal of providing the in-service teachers with a platform, through which the interactive exchange of ideas, resources, services, and expertise, mutually addressing the issues pertaining to students with ASD, can be conducted. Participants in this study include four educators from a teacher education institution, three expert teachers, and 19 in-service teacher trainees. The most significant response comes from trainees because the participating schools have the opportunity to apply the learned skills into their own classrooms.

Keyword: Special Education, Teacher Education/Development

Co-constructing a Singapore Curriculum Philosophy: Context, methodology, and application

Chairperson - Dr. Chua Bee Leng, National Institute Of Education, Singapore

Discussant - Prof David Hung, National Institute Of Education, Singapore

Educational Policies and Practices

Integrative Summary

Research evidence shows that teachers' beliefs, practices and attitudes are closely associated with teachers' strategies to shape students' learning, school improvement and effectiveness, as well as teachers' professional development. Specifically, teachers' beliefs about curriculum guide their pedagogical practices in the classrooms. Although teachers' curriculum beliefs based on four canonical curriculum orientations have been widely discussed in the literature, in Singapore, the extent to which teachers hold these views is not documented, and research on teachers' beliefs about the curriculum remain scarce. In view of this and in conjunction with our work on developing the Singapore Curriculum Philosophy (SCP), it is timely to examine the implied curriculum beliefs held by our teachers. Hence, it is pivotal to understand how teachers' beliefs about curriculum influence their teaching practices. This symposium aims to highlight the need to generate discourse on teachers' beliefs about curriculum and discuss the leverages to frame the Singapore curriculum philosophy at the national level.

Abstract 1

Framing a national curriculum discourse: Contexts and processes

Karen Lam, Ministry of Education, Singapore

Anna Cai, Ministry of Education, Singapore

Singapore students' performance in international benchmarking studies such as TIMSS and PISA has placed us at the top of the international league table of education systems. In particular, Singapore students' sustained stellar performance in the cognitive and knowledge domains at TIMSS and PISA have garnered world-wide interest in the country's education and curriculum policies, which raises the question of what theory of action guides teaching and learning in Singapore? In the educational change literature, improvements, innovations or enhancements to the school or national system can be brought about either through changes in structures and/or cultures. Paper 1 of this symposium suggests that since the introduction of the Thinking Schools Learning Nation vision in 1997, educational and curriculum change in Singapore has been driven by a theory of action that focuses on the culture of teaching. It has morphed from the individual teacher in the classroom to the collaborative teacher participating in professional learning communities; from a largely social efficiency approach to teaching and learning to a child-centred curriculum orientation; and from preparing students for a "life of tests" to guiding them to face the "test of life" (Shanmugaratnam, 2005). This presentation draws on policy documents and contemporary curriculum theories to provide a picture of the implied and extant curriculum philosophies underpinning the education system in Singapore. It also examines contextual and theoretical developments that provide the impetus to develop a Singapore Curriculum Philosophy that will further shape the country's theory of action in educational change.

Abstract 2

Co-constructing a Singapore curriculum philosophy: Method, issues and challenges

Melvin Chng, Ministry of Education (MOE), Singapore

Paper 2 of this symposium presents the process to elicit Singapore educators' vision of teaching and learning by describing their beliefs about how students learn and how teachers teach. The literature has documented the close links between teachers' beliefs, practices and attitudes that impact students' learning, school improvement and effectiveness, as well as teachers' professional development. In fact, it has been shown that the influence of teachers' beliefs on their teaching practices can contribute to about 30% of student learning outcomes. Teachers' beliefs about teaching and learning in turn offer us a glimpse of the curriculum orientations that are often the hidden forces in guiding the formulation of learning objectives, the selection of learning content and teaching methods, as well as the design of assessment methods. In this way, explicitising Singapore teachers' beliefs about teaching and

learning helps us better understand what guides their pedagogical practices in the classroom. In designing the study to understand teachers' curriculum perspectives, qualitative data was collected through focused group discussions. The data collection process was fashioned as envisioning exercises with policy makers, classroom teachers, school leaders, academics and students. There were altogether 31 envisioning groups, involving a total of 320 participants. The envisioning sessions were guided by the use of prompts to allow informants to provide rich descriptions of their beliefs about 'curriculum', teaching and learning, and how their beliefs were connected to their pedagogical practices. The data was analysed using theoretical coding, guided by the nomenclature suggested by seminal works in the literature. The data was then coded along the dimensions of (i) purpose of education, (ii) knowledge, (iii) teacher and teaching, (iii) learner and learning, and (iv) assessment before teasing out patterns in participants' responses that emerged cross the groups by quantifying the qualitative data. This paper will also discuss the issues and challenges in using this method for the study.

Abstract 3

Investigating the practice-theory links of Singapore curriculum philosophy

Tan Liang See, National Institute Of Education, Singapore

Dr. Chua Bee Leng, National Institute Of Education, Singapore

Teacher belief is a system with an adaptive function to help teachers define and make sense of their work. Belief is the state of mind in which a person thinks something to be the case, with or without there being empirical evidence to prove that something is the case with factual certainty. Teachers' beliefs about curriculum may also be shaped by educational policies, structure and processes, as well as outcomes. Hence, teachers may or may not be aware of their beliefs about curriculum. Research has shown that there is a tight coupling of teachers' belief about curriculum and their classroom practice. Given the complexities of how belief about curriculum is shaped and its direct influence on teaching and learning, Paper 3 of this symposium discusses the analysis of Singapore educators' perspectives on curriculum; and how their curriculum perspectives relate to their pedagogical practices. The emerging themes of our study indicate that teachers hold a pragmatic view on the function of the curriculum that is based on the learning needs of their students. Teachers also feel that knowledge is multidimensional and interdisciplinary in nature and thus curriculum should be flexible in developing students' critical dispositions and competencies to ask the right questions to deepen their learning. In addition, our informants also hold the view that students are co-constructors of knowledge and that teachers play a crucial role in providing guidance in student learning. Taking 'curriculum' together with 'philosophy', Paper 3 of this symposium focuses on the curriculum planned by the system and adapted to each school context by teachers, the curriculum experienced by students, as well as the principles behind the design and the enactment of the curriculum.

Keyword: Professional Knowledge, School/Teacher Effectiveness

Teacher strategies for language learning in kindergarten classrooms: Examinations across the official languages of Singapore

Chairperson - Beth O'Brien, National Institute Of Education, Singapore
Early Childhood Education

Integrative Summary

The language policy of Singapore - effective bilingualism for all students - aligns well with preparing students for an increasingly globalized world, and at the same time preserving linguistic and cultural diversity of the nation. The challenge remains with putting this policy into place within the realm of education (Curdt-Christiansen & Silver, 2012). While a majority of Singaporeans feel that their official mother tongue language is important to their overall sense of identity (66% - Matthews, ND), a language shift has occurred, whereby an increasing proportion of families report to be primarily English-speaking (MOE, 2010). Moreover, student motivation to learn their mother tongue is reportedly lapsing (Lui et al., 2008; Bokhorst-Heng & Caleon, 2009).

As other societies have found, resolving these problems may require approaching multi-language learning at an earlier age with effective teaching methods (Wode, 2010). To this point, a current topic of research is bilingual practices within preschool contexts (Palviainen et al., 2016). In order to promote additive bilingual learning, it is imperative to examine classroom practices which best support language outcomes. The talks in this symposium contribute to this focus. In four papers, teacher practices are examined across kindergarten classrooms for (1) Malay language lessons, (2) Chinese immersion and non-immersion approaches, (3) Tamil lessons, and (4) English shared book reading activities. The data were collected as part of the Singapore Kindergarten Impact Study (SKIP), with videotaped sessions of language and literacy segments of the school day across a large sample of kindergartens and child care centers. Each paper focuses on specific aspects of the kindergarten language learning environment. The first paper, using conversation analysis, investigates the manner in which Malay language teachers use English language. The second paper examines similarities and differences in teacher-child interactions between immersion and traditional classrooms for Chinese language learning. The third paper focuses on use of various strategies for teaching Tamil as related to literacy outcomes. The final paper analyzes teachers' use of comments and questions during English shared book reading, and how this relates to children's word knowledge learning.

Abstract 1

Exploring Code-Switching Strategies in Malay Preschool Classrooms in Singapore

Nurul Taqiah Binte Yussof, National Institute Of Education, Singapore

A review report on Mother Tongue teaching and learning in Singapore was published in 2010 by the Ministry of Education, which reflected the observations of various studies describing the education system as producing 'English-knowing' rather than 'balanced bilinguals'. Among the recommendations presented by the report included the adoption of a 'bilingual approach' to facilitate the teaching of Mother Tongue languages, to children from English-dominant homes. Beyond suggesting the use of English 'where appropriate' with 'beginner learners', there seems to be no official guide as to how such an approach is to be implemented in a local classroom setting. While the literature is abundant with studies in support of bilingual teaching strategies for children struggling with their L2, they also highlight the pertinence of matching the needs of the children to prevent subtractive bilingualism and overdependence on children's L1. This qualitative study will focus on how Malay teachers use English in 10 K2 classrooms, since children receive more Malay instruction in K2 than K1. Comparisons of teacher bilingual strategies are made across the classrooms to explore patterns of English use within Malay language classes. Classroom observations were first coded using a Mother Tongue Adapted Coding Scheme, developed for the SKIP project, in order to classify frequency and use of English for scaffolding learning opportunities in Malay, or for behavior management purposes. Second, conversation analysis was applied to transcriptions of the language classes as a method for observing the systematic social organization of talk. This analysis aims to examine more closely the different purposes and contexts in which teachers employ different bilingual strategies, as well as the effectiveness of different strategies for encouraging children's attempts at Malay language use and in facilitating extended child talk in Malay. Another focus is to identify instances of English use that may encourage overdependence on English. Taking into consideration children's home language background and previous Malay

language competence, this study will additionally consider the individual needs of students and how bilingual teaching strategies may cater to these needs.

Abstract 2

Differences in Pedagogy Practices between Immersion and Non-immersion Programs and their Impact on Chinese Literacy Outcomes

Leong Xuan En Rachel, National Institute Of Education, Singapore
Raymond ONG, National Institute Of Education, Singapore
Anthony ENG, National Institute Of Education, Singapore

The emphasis on bilingual education for Singapore preschool children is largely driven by societal expectations of proficiency in both the English language and mother tongue. This is further reinforced by the employment of streaming procedures in the primary curriculum. Consequently, there has been a rise in preschools providing immersion programs in recent years. Teachers in immersion schools employ the use of a two-way immersion model whereby instruction time is split equally between English and mother tongue. However, to date there are no clear guidelines as to how such programs should be conducted in Singapore preschools (Curdt-Christiansen 2016) and literature that discuss the effectiveness of said programs are scarce.

This study, conducted within the scope of the 'Singapore Kindergarten Impact Project' (SKIP), has two parts. Firstly, we examine the impact of immersion programs on children's Chinese proficiency level. Secondly, we explore the strategies that teachers employ in Chinese lessons for both immersion and non-immersion schools to examine the differences in the quality of Chinese lessons between the different types of schools. Data on children's Chinese proficiency were collected by assessing receptive vocabulary, character recognition, character naming, writing and morphological awareness. Observations of Chinese lessons in classrooms were video-recorded and the quality of these lessons were coded using a Chinese Classroom Adapted Coding Scheme (CCACS), consisting of three aspects – Quality Language Input, Output, and Varied Strategies. Preliminary results from MANOVA analysis show no significant difference in all measures of Chinese proficiency between immersion and non-immersion school types. Further analysis focuses on the differences in CCACS scores between the Chinese immersion and non-immersion classrooms. An exemplar from the immersion sample with consistent high scores on CCACS over two years is also examined qualitatively. Altogether, these findings will illustrate how various teaching strategies may impact children's literacy outcomes and will help to inform implementation and planning of bilingual language and literacy programs in preschools.

Abstract 3

The Relationship between Early Literacy Skills and Teaching Strategies in Tamil Classrooms

Ms Poorani V, National Institute Of Education, Singapore
Mrs Malikka HABIB, National Institute Of Education, Singapore

Bilingual education in Singapore is introduced first in preschool, with learning English as the first language and mother tongue as the second language. However, there is not much literature focused on teaching the second language in preschool classrooms. This study, conducted within the scope of the 'Singapore Kindergarten Impact Project' (SKIP), describes the teaching practices and student outcomes in Tamil preschool classrooms in Singapore. According to the 'Nurturing Early Learners' (NEL) curriculum framework, knowledge of basic Tamil language is one of the main goals for preschool mother tongue classrooms.

Therefore, in this study we explore the literacy skills of Tamil students and relate it to the various teaching strategies that are employed by Tamil teachers in their classrooms. Six classrooms which were taught by 4 teachers were video-recorded and coded according to a Tamil Classroom Coding Scheme (TACCS) over the span of two kindergarten years, once in K1 then again in K2, for this study. It was observed that when the reading skills of the 37 students in these classrooms were measured, they were found to improve significantly ($p < 0.001$) from K1 to K2. This is in line with all the teacher's TACCS codes, specifically those related to encouraging reading skills, which showed improvement from K1 to K2 as well. Furthermore, the teacher who had the highest and most consistent TACCS scores across the two waves is used as a case study in this study. Her teaching practices show efficient strategies with regards to language forms, concept development, and language modelling and scaffolding. The students in her class showed a significant improvement ($p < 0.05$) in literacy skills from K1 to K2.

Generally, these findings are in line with studies which show that quantity (language forms) and quality (concept development and language modelling and scaffolding) are both important when considering second language proficiency. In conclusion, this study hopes to contribute to the limited literature about teaching strategies for second language in preschool classrooms.

Abstract 4

Instructional Strategy And Language Complexity In Preschool Teacher's Shared Book Reading: Variation and Effectiveness

Sun He, National Institute Of Education, Singapore

Early vocabulary knowledge is one of the strongest predictors of later school performance, and teachers' language practice during Shared Book Reading (SBR) is found to significantly affect the rate and outcome of such development. The current study has zoomed in on the SBR sessions in Singapore preschools, 1) exploring the instructional strategies teachers use and the linguistic features they have; 2) investigating the effectiveness of teacher's language on children's vocabulary knowledge development; and 3) linking teacher's variations in language use to their background (e.g., teaching experience). Thirty-eight preschool teachers and 440 children (4-5 years old) were investigated. Their shared book reading sessions have been video recorded. Two research assistants have transcribed these videos with CHAT and coded them using CLAN. Teacher's instructional strategies via comments and questions during SBR have been categorized as high, medium or low level (Distancing model) according to their potential cognitive load on children's mental activity. Teacher's language sophistication was estimated with syntactic complexity (MLU word), lexical complexity (average word length) and lexical diversity (D). Children's word knowledge has been operationalized as receptive vocabulary size and word reading skills (measured with BLAB and WRAT-4) at the beginning and at the end of children's first preschool year. Teachers' background information (e.g., teaching experience) has been collected with questionnaire.

Results demonstrate that teachers' language strategy and linguistic complexity varied from each other and such variation would probably affect children's vocabulary knowledge development. After controlling children's initial language score and age, instructional strategies with medium level of cognitive load was found to facilitate children's growth in receptive vocabulary size and word reading skills. Besides, it was found that children's receptive vocabulary development was positively related to teacher's lexical complexity but negatively related to lexical diversity. Years of teaching was found to predict teacher variation: the more years of teaching experience teachers have, the more medium-level instruction and sophisticated words they would use. Professional development needs, teachers' educational level, class size and teachers' personality were also related to teachers' instructional strategy or language complexity.

Keyword: Bilingual/Bicultural Education, Early Childhood

Understanding Motivation in the classroom: Evidence and Practices

Chairperson - Liu Woon CHia, National Institute Of Education, Singapore
Cognition, Motivation and Learning

Integrative Summary

Integrative Summary:

This symposium will provide some insights and practical strategies for teachers, school leaders and policy makers to enhance student motivation in the classroom. Three speakers will share their empirical research and experience in this area. A few questions will be discussed 1) how difficult it is to implement motivational strategies in the classroom? ii) what would be the benefits for teachers to implement these motivational strategies? iii) what is the value of tangible rewards and its impact on motivation in the classroom? and iv) how school can support student motivation?

The audience may find some answers to the above questions through a series of three presentations in this symposium. First, Professor John Marshall Reeve will share his research in autonomy-supportive classroom, what it is and how to do it? Professor John Wang will share his research in antecedents of teachers' use of motivational strategies in the classroom. Finally, Dr Dennis Kom will talk about understanding motivational practices in the school and classroom contexts. After the three presentations, Professor Liu Woon Chia will be the discussant.

Abstract 1

Helping Teachers Develop a More Autonomy-Supportive Classroom Motivating Style

Johnmarshall Reeve, Department of Education, Korea (South)

I will present a SDT-based program of research that invites teachers to participate in an autonomy-supportive intervention program (ASIP) designed to help them become more autonomy supportive toward their students during instruction. It can be difficult for teachers to generate and implement engagement-fostering instructional strategies in a reliable, valid, and side-effects-free way, so I argue that motivation researchers need to do a much, much better job of helping teachers translate motivation principles into highly effective, easy-to-do, and culture-congruent classroom practice. In our research, we find that both students and teachers alike benefit enormously from teachers' participation in our ASIP, and I will overview this empirical evidence. To address the question of rewards, our research shows that teachers can use rewards in a structure-enhancing and engagement-fostering way, if those rewards—like any element of classroom structure—are offered in a highly autonomy-supportive way. I conclude by making it clear what an autonomy-supportive motivating style is and also how to do it, because becoming more autonomy supportive offers teachers an excellent opportunity to develop themselves professionally by meaningfully upgrading the quality of their classroom motivating style.

Abstract 2

Factors Influencing Teachers' Use of Motivational Strategies in Mathematics

John Wang, National Institute Of Education, Singapore
Liu Woon CHia, National Institute Of Education, Singapore
Adrian Kee, National Institute Of Education, Singapore
Zason Chian, National Institute Of Education, Singapore

Teachers play a key role of developing students. This purpose of the current study was to examine the antecedents affecting teachers' use of motivational strategies in the classroom. Using the Self-Determination Theory (Deci & Ryan, 1985) framework, teachers can nurture intrinsic motivation in their students by supporting their autonomy instead of controlling their behavior in the classroom. What would determine the kind of strategies teachers use is not known. A total of 1549 students and 80 Mathematics teachers took part in the study. Results of the Structural Equation Modeling showed that teachers' autonomous orientation and their perceived students' autonomy positively predicted teachers' need satisfaction, whereas perceived pressure from school authority negatively predicted teachers' need satisfaction. In addition, if teachers' psychological needs are being satisfied, they are

more likely to have autonomous motivation and actively using motivational strategies in their classroom to promote intrinsic motivation among their students. From their students' perspective, if students perceived that their psychological needs are being satisfied in the Mathematics classroom, they too are more likely to have autonomous motivation, this in turns, lead to higher enjoyment and value the subject more, with less pressure.

Abstract 3

School Connectedness and Motivation in Learning

Dennis Kom, Ministry of Education (MOE), Singapore

Motivation is a function of the dynamic interactions between a person and his environment. This presentation explores the influences of the school environment and practices, particularly the notion of school connectedness, on students' motivation in learning. School connectedness is students' belief that adults and peers care about them and their learning, and is associated to positive educational outcomes that include better school attendance, lower rate of school dropout, better academic achievement and lower likelihood of engaging in problematic behaviours. This presentation will survey pertinent aspects of school connectedness, such as interactions with adults, relationships with peers, the ethos of learning and the social and emotional climate of the school that will promote student motivation in learning.

Keyword: Motivation, Psychology

Exploring the Quality of Teacher-child Interactions in Preschools: Insights from the Singapore Kindergarten Impact Project

Chairperson - NG Ee Lynn, National Institute Of Education, Singapore
Early Childhood Education

Integrative Summary

The Singapore Kindergarten Impact Project (SKIP) is a 3-year longitudinal study which started with K1 children in 2015. SKIP aims to examine how the quality of classroom interactions, together with home support and children's cognitive capabilities, influence children's school readiness and later performance in primary school. Through SKIP, we have amassed a rich database of information about classroom practices and teacher-child interactions in preschools using well-known observational tools, namely the Classroom Assessment Scoring System (CLASS) and the Early Childhood Environment Rating Scale-Revised (ECERS-R). In this symposium, we draw on this data to address several issues pertaining to the relation between the quality of classroom interactions and children's development and learning.

The first presentation uses CLASS and ECERS-R data to examine the extent to which classroom practices in local preschools are aligned with developmentally appropriate practices for supporting children's learning and development. The second presentation examines the quality of teacher-child interactions during non-instructional periods (i.e., meal/snack times) and the challenges that teachers face in providing good quality interactions during these periods. The third presentation zooms in on interactions and teaching strategies that occur during Mother Tongue lessons. Specifically, the authors examine the reliability of a locally-developed observational tool (the Mother Tongue Adapted Coding Scheme) in comparison to the CLASS and how the quality of interactions relate to children's competencies across different Mother Tongue languages. The fourth presentation tackles the issue of stability in teacher-child interactions and how the degree of stability in a classroom relates to academic and social-emotional outcomes. Together, this set of papers highlight how data on local classroom practices can be used to address issues of educational relevance and to suggest areas for improvement to create a more conducive learning environment for children.

Abstract 1

Alignment between Pedagogical Principles and Classroom Practices in Singapore Preschool Education

SNG Wei Qin, National Institute Of Education, Singapore
Dr Alfredo BAUTISTA, National Institute Of Education, Singapore
Rebecca BULL, National Institute Of Education, Singapore
NG Ee Lynn, National Institute Of Education, Singapore

The Nurturing Early Learners (NEL) Kindergarten Curriculum Framework (MOE, 2012) articulates MOE's beliefs about how young children learn and develop. At the center of the Framework is the belief that children are active, curious and competent learners. Based on this belief, the framework advocates iTeach, the acronym for the six principles which guide teaching and learning. These are (i) integrated approach to learning; (T) teachers are facilitators of learning; (e) engaging children in learning through purposeful play; (a) authentic learning through quality interactions; (c) children are constructors of knowledge; and (h) holistic development. All of the principles are guided by philosophy, theory and research, e.g., Dewey (1959), Vygotsky (1962, 1966, 1978), Piaget (1932), Caine and Caine (1991), Fler (2011), Siraj-Blatchford and Sylva (2004), and Pestalozzi (1746-1827). Similar principles to iTeach are seen in many early childhood curricula worldwide, and are believed to be developmentally appropriate practices for supporting children's learning and development.

The NEL Framework is disseminated across the preschool sector. Whilst adherence to the NEL is not mandated, the Early Childhood Development Agency (ECDA) actively promotes reference to the Framework to guide centers in the development of their curriculum and pedagogy. Whilst many preschools now reference the iTeach or similar principles, it is unclear how the iTeach principles are enacted in preschool classrooms. In the current presentation, we align the iTeach principles with relevant criteria collected as part of preschool classroom observations using the Classroom Assessment Scoring System (CLASS) and the Early Childhood Environment Rating Scale-Revised (ECERS-R) conducted within the scope of the Singapore Kindergarten Impact Project (SKIP). This will help to highlight where there is clear observable evidence of the iTeach principles being enacted in the classroom, and also areas where there is a clear gap between theory and practice. Reasons for the gaps will be considered (e.g.,

parental expectations, impracticalities in the classroom) and may also highlight areas where preschool educators required further professional development opportunities.

Abstract 2

The Quality of Teacher-Child Interactions during Meal/Snack Times in Singapore Preschools

Ms Anisa RAHIM, National Institute Of Education, Singapore

David MÚÑEZ, National Institute Of Education, Singapore

YAO Shih-Ying, National Institute Of Education, Singapore

Understanding the effects of classroom experiences on child development has garnered increased attention in recent years. Research findings indicate that better classroom quality leads to greater achievement in young children. Whilst better classroom quality environments have been linked to typically instructional settings (e.g., whole group), less is known about non-instructional settings (e.g., meal/snack times).

Meal/snack times provide a platform for children to interact with their peers and teachers in a social environment. While preschool teachers are encouraged to engage children in high-quality interactions even during non-instructional times, it can be challenging for them to do so for various reasons (e.g. lack of time and/or staff). A better understanding of what occurs during meal/snack times can help provide suggestions on how to overcome the obstacles specific to this period.

Using the Classroom Assessment Scoring System (CLASS) to study meal/snack times, we: (1) explore the quality of teacher-child interactions; (2) examine the challenges faced by teachers; and (3) provide descriptions of high-quality interactions. Data for the current study is drawn from an ongoing large-scale longitudinal study examining how preschool experiences influence children's learning and development. Classroom quality was evaluated using the CLASS, an observational instrument that evaluates the following three domains: Emotional Support (supporting social and emotional functioning), Classroom Organisation (organising and managing children's behaviour, time, and attention), and Instructional Support (how the curriculum is implemented to support cognitive and language development).

Video recordings of 116 K1 and 111 K2 classrooms were collected in 2015 and 2016 respectively. Whole day recordings were split into 4 to 6 episodes that were coded by certified CLASS coders. The current study focused on classrooms that contained a meal or snack time session; we explored teacher-child interactions from 45 K1 and 49 K2 classrooms.

Results indicate that teacher-child interactions during meal/snack times in preschool are in the middle range for the Emotional Support and Classroom Organisation domains, while Instructional Support was low. Findings are discussed in the context of the Singapore preschool sector. Additionally, exemplars of high-quality interactions are provided to depict how preschool teachers in Singapore can engage children in high-quality interactions during meal/snack times.

Abstract 3

Mother Tongue Preschool Interactions and Teaching Strategies: Comparing the CLASS and the Mother Tongue Adapted Coding Scheme

Nurul Taqiah Binte Yussof, National Institute Of Education, Singapore

Leong Xuan En Rachel, National Institute Of Education, Singapore

Nur Artika Arshad, National Institute Of Education, Singapore

The Classroom Assessment Scoring System (CLASS) is an observational tool used by SKIP to assess classroom quality in three domains: emotional support, classroom organization and instructional support. While CLASS was used to code various classroom activities ranging from small and large group instruction to snack, play and gross motor activities, another coding scheme, the Mother Tongue Adapted Coding Scheme (MACS) was developed to focus on observing interactions and strategies during Mother Tongue (MT) language and literacy instruction.

The MACS was developed based on existing classroom coding tools including the CLASS, the Input Quality Observation Scheme that observed the quality of teacher's L2 input, and various other studies that observed

different characteristics of quality in language and literacy instruction. MACS contains four dimensions: input characteristics, output characteristics, varied strategies and English use to support MT teaching. Aside from focusing on language and literacy instruction, the scheme was designed to be more applicable to the different MTs taught in local preschool classrooms. The MACS does however have indicators that are similar to those in CLASS: 'Mother Tongue Focus on Concept Development' to observe how teachers used MT as a language of instruction across different learning areas; 'Positive Climate for Mother Tongue Use' that looks at how emotionally supportive classroom conditions are and how successful they are in eliciting child talk in the MT; and 'Language Modelling and Scaffolding' that looks at frequencies of children talk, given teacher's modelling and scaffolding strategies.

This paper compares the reliability of the MACS and CLASS in assessing the quality of language and literacy characteristics in local MT classrooms. We examine (1) how the CLASS and MACS are related to each other and (2) how they are related to children's language and literacy competencies across the three MTs: Mandarin, Malay and Tamil. The analysis is based on a sample of 20 classrooms that have been coded on the CLASS and MACS (4 Mandarin, 10 Malay, 6 Tamil classrooms) with a total of 160 children (44 Chinese, 69 Malay, 47 Indian children). More participants and classes will be included as data coding and analysis are still underway.

Abstract 4

Stability in Classroom Interactions: Preschool Teachers' Emotional Supportiveness and Children's Academic and Socio-emotional Outcomes

NG Ee Lynn, National Institute Of Education, Singapore

YAO Shih-Ying, National Institute Of Education, Singapore

Raymond ONG, National Institute Of Education, Singapore

Nirmala KARUPPIAH, National Institute Of Education, Singapore

Teacher-child interactions in the classroom can be grouped into three domains: instructional support, classroom organization, and emotional support (Pianta, La Paro, & Hamre, 2008). Many studies have shown that the quality of these interactions are key predictors of children's academic and social outcomes (e.g., Curby, Rimm-Kaufman, & Ponitz, 2009; Mashburn et al., 2008). However, few studies have examined the stability of these interactions throughout the day and its impact on child outcomes. It has been argued that classrooms with highly stable interactions are more conducive to learning as children know what to expect and are able to focus their attention on learning tasks (Curby, Grimm, & Pianta, 2010). In contrast, being in less-stable classrooms is detrimental to a child's ability to function, in part because their attention is directed towards monitoring and deciphering the behaviors of an unpredictable teacher (Curby et al., 2010).

This paper explores the stability of teacher-child interactions in preschool classrooms and how the degree of stability relates to children's academic and social-emotional outcomes. Our investigation focuses on the quality of teachers' emotional support (ES), defined as teachers' ability to promote children's social and emotional functioning through the development of positive and warm relationships. Five-year-olds (N = 1131) from 108 classrooms participated in this study as part of a larger study (the Singapore Kindergarten Impact Project). In the first year of kindergarten (2015), we collected data on the quality of teachers' ES using the Classroom Assessment Scoring System (CLASS). We define ES stability as the magnitude of change in teachers' ES quality scores across multiple observation cycles throughout a day. Children completed a battery of academic and socio-emotional tasks towards the end of 2015 (Time 1) and in the middle of 2016 (Time 2). Preliminary results show that ES stability is significantly associated with mathematics and affect recognition skills at Time 1 and 2. Further analyses will examine the predictive value of ES stability on concurrent (Time 1) and longer-term (Time 2) child outcomes. Our findings will shed light on the value of providing an emotionally nurturing and consistent preschool environment for children's learning.

Keyword: Classroom Research, Preschool

Establishing adaptive capacity through diffusion of educational innovations: a multi-scalar notion of ecosystem resilience

Chairperson - Prof David Hung, National Institute Of Education, Singapore
School Change and Leadership

Integrative Summary

The literature on school change is littered with somber reports of how educational innovations have failed to create impact on teaching and learning. Even when evidence-informed successes are palpable, they are rarely sustainable due to traditional "grammar of schooling" (Tyack and Tobin, 1994). Situating educational innovations in our context, there are two main unifying cultural and rhetorical representations on school change: 1) the need to equip students with 21st century competencies and 2) the decentralisation movement to encourage endogenous renewal of schools for 21st century learning. However, the school landscape is diverse and schools' innovation readiness can differ considerably. How, then, can we level the innovation capacity of schools that are less ready and how can schools sustain their innovation gains after initial success? A plausible way is to create leverages by establishing an innovation ecosystem. We posit that a successful innovation ecosystem engages in symbiosis. Externalization of embodied knowledge, co-production of new knowledge and presence of supporting socio-technological infrastructure can potentially lead to socio-ecological resilience and innovation sustainability. We define resilience as the adaptive capacity of actors in the innovation ecosystem to respond to threats in ways that the spirit of 21st century learning embedded in the educational innovations can be sustained despite challenges. As expounded by Bergstrom and Dekker (2014), resilience can be construed at multi-scale levels. We shall focus on the interplay of network, organisational and learner resilience.

Based on a series of case studies, the first presentation will touch on how the social capital embedded in various multi-level learning networks can proffer diversity in competencies and facilitate transfers, or 'ecosystem carryovers' (Adner, 2012) leading to adaptive expertise. The second presentation foregrounds organisational resilience, in particular, how school leaders build internal capacity in establishing nuanced and differentiated responses to contextualized challenges. The third presentation focuses on human resilience, explicating how individual agency can interact with other levels of the subsystems to circumvent predicaments when local context proves to be inhospitable. The fourth presentation delves into innovation affordances that can nurture learners' grit and perseverance. The implications of "resilience" on policymaking and practices will also be discussed.

Abstract 1

Building adaptive capacity: Transferring social capital within multi-level learning networks

Sham Ravee, National Institute Of Education, Singapore
Yancy Toh, National Institute Of Education, Singapore
Prof David Hung, National Institute Of Education, Singapore
Lee Yu Ling, National Institute Of Education, Singapore

Schools have been 'nudged' to spread promising educational innovations and yet the variability of the success of innovation diffusion begets the question – why can't we just innovate. The diffusion process is not simply a matter of mechanical implementation but it also represents organizational transformation where the embedded social networks play a pivotal role. The networks of social relations and the highly 'social' nature of schools comprise many explicit and implicit codes that govern and guide its practices. These codes can be characterized as forms of capital within and between individuals. One of the forms of capital which has deep implications for innovation diffusions is social capital (Moolenaar & Slegers, 2010). Social capital has been defined and described under many paradigms (Coleman, 1990; Bourdieu, 2001; Portes, 1998; Fukuyama, 2001). This presentation will make reference to the definition of social capital as the "aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and recognition" (Bourdieu, 1983, p. 248). As ideas and knowledge are exchanged and transferred across networks, they may lead to an increased adaptive capacity in the organisation. We argue that adaptive capacity is built and sustained through the availability and exchanges of capital within the system. Adaptive capacity in this instance refers to the system's ability to adjust and manage disruptions, moderate potential threats and also to take advantage of opportunities for transformation and coping with its consequences (Gallopín, 2006, p. 296).

This presentation will aim to dive into the forms of social capital embedded within two innovation networks that focusses on the pedagogy of knowledge building and cross-contextual learning, demonstrating the flow of capital and how adaptive capacity can be buttressed through diversity of knowledge. The presentation will also elaborate how actors with system leverages can also be the brokers to provide much-needed capital for other schools to build up contextual readiness for innovations. These have implications for policymakers and school leaders who may want to take into consideration the management of social capital when planning for organisational change.

Abstract 2

Architecting organizational resilience for inquiry-based pedagogical innovations: A journey well-journeyed?

Yancy Toh, National Institute Of Education, Singapore
Prof David Hung, National Institute Of Education, Singapore
Lee Yu Ling, National Institute Of Education, Singapore
Sham Ravee, National Institute Of Education, Singapore

Inquiry based practises have been seeded in Singapore schools across different domains and grade levels. It refers to the instructional practises that depart from traditional didactic, memory-oriented approaches to promote knowledge seeking endeavours through student-driven investigations supported by facilitation (Justice et al., 2009). Whilst there are pockets of successful implementations of such pedagogical innovations, there are also ground sentiments that school culture can sometimes 'militate' against inquiry practises, thus challenging the longevity of nascent changes in teaching practises. How can schools sustain the new culture they have cultivated? Coalescing around the notion of "organisational resilience", this presentation would aim to explicate why some schools appear to be more resilient to both internal and external shocks and continue to deepen their inquiry culture over time.

Lee, Vargo and Seville (2013) operationalize resilience as a function of two factors: adaptive capacity and planning. The former comprises leadership practises that mitigate social, cultural and behaviour barriers to promote the mobilisation of resources for innovations, collaborations and evaluations. The latter comprises planning strategies to anticipate potential vulnerabilities, respond to crisis and outline recovery priorities. Based on the interviews of six principals, we shall discern the constellation of practices the school leaders employ to enhance the resilience of their schools, paying attention to the cultivation of adaptive capacities and formulation of planning strategies. The six schools where the principals are situated in have enacted whole-school inquiry-based innovations that are on-going for at least five years. Both boundary spanning and capacity building are evident across the six enduring cases, and thus can be considered as exemplars. The resilience strategies used include establishing common memory and cognition amongst actors, acting as ecological brokers who exercise 'ritualised ingenuity' (Coutu, 2002) and institutionalising promising trajectories and spanning disciplinary boundaries. In terms of innovation implementation, the strategies differ especially in terms of coupling formal and informal leadership as well as the interplay of top-down support and bottom-up initiatives. The presentation will also delve into the implications for "resilience engineering" (Bergström and Dekker, 2014) and discuss the possibilities of creating pathways for achieving resilience.

Abstract 3

Overcoming school-based impediments: Understanding bricolage and reconfiguring resources

Yancy Toh, National Institute Of Education, Singapore
Prof David Hung, National Institute Of Education, Singapore
Lee Yu Ling, National Institute Of Education, Singapore

Inter-connectedness is one of the hallmark characteristics of an adaptive system. Such couplings can manifest in the form of policy, social, epistemic and temporal connectivity. We posit that the externalization of tacit knowledge is dependent on how well-connected these four aspects are; which will in turn influence how well-poised the experimental teachers are in terms of overcoming innovation constraints that can emanate from different sub-systems of the school ecology. Some of the more common and notable impediments faced by teachers when implementing innovations include: limited maneuverability within saturated curriculum and learning spaces; risk-averse school culture, difficulty in shifting epistemological stance as well as inadequate resources.

This presentation focuses on how teacher champions and departments tinkering with innovations can overcome impediments arising from their local contexts. The first qualitative case study is an illustration of how an innovative teacher in a mainstream school managed to overcome multiple disjunctures and organizational constraints to implement an educational innovation that focuses on knowledge co-construction by leveraging resources beyond the schools. The ebb and flow of positive and negative feedback loops, together with the co-existence of other socio-technological infrastructures had built up the adaptive expertise of the innovation teacher while she assessed the conditions to re-establish the innovation within local context. The second case study explicates how a team of experimental teachers and middle managers from a mainstream school have navigated their innovation dissonance and built up their design capacity by tapping on nation-wide resources and working with researchers. The third case study illustrates how an intra-school professional learning community was re-configured over several iterations to achieve reciprocity amongst actors, culminating into a stable state of relational affinities. The case studies have implications on how our system can think about the intentional design of an innovation ecosystem. The perennial principles of building a robust bricolage are: long-term on-going engagement for epistemic convergence amongst stakeholders; making innovation risks less daunting by practicing multi-scale shared accountability; proffering alternative microcosms for professional learning and in-situ resource configuration as well as creating a strong ethos for sharing challenges associated with innovation journeys.

Abstract 4

Tracing learner resilience becoming through innovation instantiations in schools: Case studies of grit, perseverance, and tenacity

Dr Azilawati Jamaludin, National Institute Of Education, Singapore

Prof David Hung, National Institute Of Education, Singapore

Tan Aik Lim, National Institute Of Education, Singapore

In this presentation, we delve into micro-level instantiations of resilience, focusing on educational innovations in schools that develop students' desired 21st century abilities of grit, perseverance, and the tenacious ability to overcome failure and adversities in their process of learning—an aggregated concept we term as learner resilience. Introduced to the field literature in 1970, the notion of resilience has been an important and interesting concept which have been studied in social sciences (Luthar, 2006). In at least the last decade, the importance of learner resilience is exacerbated against a milieu of exponential changes and demands as it is the capacity of successfully enduring and resisting the factors that threaten development and adaptation to life (Masten, 2014), of positively accommodating oneself to challenges (O'Dougherty et al., 2013), and adapting to growth and change (Dweck, 2012; Duckworth & Seligman, 2005) that constitute high leverages for a meaningful and successful life. Through tracing students' becoming trajectory as they engaged in innovative spaces of learning such as design and tinkering through interest-driven spaces, we adopt an eco-systemic perspective of analysis that unpack learner resilience at the micro-ontogenetic, meso, and macro system layers (Bronfenbrenner, 1979).

Adopting a case study approach, our data points to the importance of individual learner ontogenetic resource development that affords outreach at the micro level; fundamental relationship and affinity development at the meso level; and positive ecology support at the macro level underpinning the development of learner resilience becoming. Commensurate with extant international literature on resilience as a key construct for academic success (Fourie & Theron, 2012; Gilmore et al., 2013; Murray, 2003), we contend that teachers remain instrumental to learner resilience becoming processes. In many ways, this bear implications on teacher education and development which draw focus to the potentiality of teachers championing resilience through innovative practices in schools. We discuss how educational innovations situated within school ecologies mattered for resilience and how these insights may afford development of learner resilience that not only resonates with desired outcomes of education, but also as functional imperatives for the meaningful well-being of our young generation in new eras of change.

Keyword: School Change and Leadership

Educational innovations as catalyst for change: Partnerships with stakeholders and subsystems in the Singapore education ecology

Chairperson - Shu-Shing Lee, National Institute Of Education, Singapore
School Change and Leadership

Integrative Summary

The Singapore education system recognizes educational innovations as ways for schools to remain relevant for 21st century, student-centred learning. Educational innovations shape change in individuals, cultural, and social systems. The challenge is to balance student-centred practices while maintaining learning experiences and academic outcomes. From an ecological viewpoint, the Singapore education system comprises nested subsystems involving micro-, meso-, exo-, and macro- levels which have bearings on innovation diffusion. The micro-level relates to classroom-level influences; meso-level refers to organizational attributes; exo-level constitutes influences exerted by peripheral members of the school ecology; and macrosystem refers to national or global trends, policies and initiatives that influence Singapore's education. Our ecological framing recognizes schooling systems as embedded in socio-cultural constructions. Analysis of change considers ecological subparts within the system. Schools' ability to change depends on inter- and intra- relationships with other subsystems and stakeholders. This symposium describes four studies discussing tenets of change shaping educational innovations in inquiry-based learning for Science.

The first presentation takes an evolutionary, ecological perspective focusing on all levels of change across subsystems in the education ecology. It describes a school's change journey by unpacking adaptations made to ICT-mediated, educational innovations based on lessons learnt and schools' changing needs. The second and third presentations focus on meso- and micro-levels of change by unpacking structures and processes schools created to initiate and sustain ICT-mediated innovations in a primary and secondary school respectively. Both presentations highlight intra- and inter-relationships established within and beyond school subsystems to trigger and sustain change. Teacher learning and change is key to enacting innovations and changing practices in classrooms. The last presentation focuses on teachers enacting the innovation at the micro-classroom level; describing challenges teachers faced, and how they used student artefacts and voices to refine and reflect practices.

This symposium contributes by unpacking structures and processes that schools create while harnessing relationships with other subsystems in the education ecology to seed innovations, change, and sustain practices. It provides triangulated insights from multiple stakeholders' lens of how innovations enabled new practices and helped teachers reflect their roles and practices.

Abstract 1

Enabling an innovation ecosystem: A school's journey of navigating multifarious challenges of ICT-mediated change process

Yancy Toh, National Institute Of Education, Singapore
Yin Hong Cheah, National Institute Of Education, Singapore

Teaching with technology has long been a nefarious or 'wicked problem'. The multifarious complexities are exacerbated when the use of technology is situated within the broader socio-cultural context of varied and diverse school/classroom ecologies. Such use of technology entails the perpetual marshalling of resources to resolve enfolding tensions that can emanate from unstable technologies, intransigent teaching beliefs and practices, inhospitable environment and unforeseen exogenous shocks, just to name a few. The challenges are more exemplified when technology-mediated innovations travel from one school to another as the innovation translation process is rarely a mere supplanting of what works at the seeding school to new pedagogic sites. In this light, this presentation delves into the struggles of how a mainstream school with passive innovation culture attempts to build capacity through participating in across-schools collaboration. Notwithstanding the fact that the champion school of the collaborative network has created socio-cultural and cognitive affordances that other schools in the network can possibly harness, the innovation-adopting school still faces a whole slew of challenges when implementing the innovation at its localized site. These difficulties stemmed from the micro epistemic level of actors, meso-level implementation issues as well as limited parental support and leverages at the exo-level. These challenges remain tenacious despite the fact that there is presence of strong political will, sound structural mechanism of learning spaces as well as cultural readiness of the department tinkering with the innovation. The alignments and

misalignments of actual and espoused goals will be unpacked. Data is drawn from interviews as well as observations of lessons, professional learning communities and dialogues with stakeholders. The implications of findings on learning and teaching as well as the broader socio-cultural landscape in which educational innovations are situated in will also be discussed. It is hoped that the study will: (i) provide us with a more articulated sense of the difficulties of establishing an innovation ecosystem within the school and (ii) evoke the collective imagination of how school-to-school coupling can be more efficacious for schools that start afoot from a less established baseline.

Abstract 2

Developing future-ready entrepreneurial learners: Instantiations from Secondary Science classrooms

Dr Azilawati Jamaludin, National Institute Of Education, Singapore
Seah Lay Hoon, National Institute Of Education, Singapore
Frederick T. Talaue, National Institute Of Education, Singapore
Buana Sandila Putra, National Institute Of Education, Singapore

Creating sustainable educational innovations has gained currency in the 21st century interactional landscape that necessitates novel knowledge, skills, and dispositions for future-ready learners. There exists pressure for schools, educators, and researchers to implement educational innovations that bring improvements to teaching and learning, aligned to the 21st century workscape. Within this vein, there is a need to build learning environments that foster entrepreneurial learners—not entrepreneurs but entrepreneurial learners who are looking for new ways, resources, peers and potential mentors to learn new things. Entrepreneurial learners for the 21st century are those equipped with the desired inquiry, critical thinking, reasoning, and argumentation skills to ‘pull’ disparate information into coherent, personally meaningful understandings. Yet, such an entrepreneurial disposition seems antithesis to the gamut of learning systems today that primarily ‘push’ information to students. In parallel, research on the enacted curriculum in Singapore classrooms similarly reflect the need for more agentic ‘pull’ environments of learning where students are positioned as change agents (vis-à-vis mere information recipients) who must understand and apply academic content as conceptual tools to effectively engage in joint context creation for meaningful learning. Against this backdrop, our work focuses on developing students’ critical thinking, reasoning, and argumentation skills to not only ‘pull’ disparate pieces of information into coherent understandings but to also translate and apply such skills as tools for future meaning making. This presentation outlines the pedagogical change process towards developing future ready entrepreneurial learners within Secondary Science classrooms. Paying particular attention to teacher and student enactments at the micro- and meso-school levels, we articulate aspects of the change process that facilitate the spread of a Science educational innovation within a mainstream Secondary school in Singapore. Drawing our analysis from classroom observations, interviews, curriculum documents and student artefacts, we i) explore the nature of the pedagogical change process instantiated by an edulab ‘Investigative Analysis and Structured Argumentation (IASA) innovation, ii) outline two categories of change and its entailing meso- and micro-level impacts, and iii) propose a preliminary set of design principles for implementing successful pedagogical innovation change. Implications within a broader ecological framing of educational innovations will be discussed.

Abstract 3

Implementing Educational Innovations in Schools: Same innovation, different pathways, and outcomes

Peter Seow, National Institute Of Education, Singapore

The presentation explores the implementation-change pathways of two schools at the meso- and micro- levels of analysis. It discusses how both schools implemented educational innovations by redesigning their Primary 3 Science lessons to incorporate inquiry-based learning integrated with the use of technology. The schools started together with the same objectives of improving inquiry-based learning for the lessons on plants, but each school took different pathways in implementing educational innovations. This study used designed-based implementation research (DBIR) as methodology to study the implementation-change process in which researchers and teachers were involved in co-designing lessons, while teachers enacted the designed lessons in the classroom. The researchers participated closely with school leaders and teachers in the implementation of the educational innovations. Research notes were taken to record the implementation-change process and stages. Lessons enacted by the teachers were observed with feedback given to the teachers by the researchers. Interviews of the school leaders and teachers were conducted at the end of the project to understand the implementation process

and decisions made by the drivers of the educational innovations. In our analysis, we examine the stages, drivers and the improvement cycles of the implementation-change process of each school, to develop an understanding of how each school's pathways lead to different outcomes in lesson design and student learning. As a result of the participatory activities between the school leaders, teachers and researchers, they developed capacities in areas of curriculum knowledge, instructional design, and application of technology. The process of implementing innovations and practices not only improves students' learning outcomes but also builds capabilities in the school that are needed to respond to change.

Abstract 4

Change in classrooms: Teachers' episodes of dissonances and triumphs for enacting inquiry learning in Science

Shu-Shing Lee, National Institute Of Education, Singapore
Peter Seow, National Institute Of Education, Singapore

Teacher learning and capacity building is key for enacting ICT-mediated innovations and sustaining changed practices. Changing practices towards inquiry requires teachers to understand inquiry, enact, and adapt practices for their own contexts. Capacity building situated within practice enables teachers to take ownership, reflect, and refine changed practices as everyday work. This presentation focus on meso- and micro-levels of change. It shows how one primary school initiated an innovation as means for situated, contextualised professional development. Situated professional development relates to how teachers learn on the job as they tackle practice-oriented problems, develop solutions by inquiring and reflecting their practices to improve professional knowledge and professionalism. The intent of this case study is to show how teachers redesign and reflect on Science lessons and shift towards inquiry. This case study will discuss how a professional learning community, comprising researchers and teachers, went through an iterative process of translating understandings of the 5E instructional framework, designing, enacting, and refining lessons. This iterative approach helped teachers create contextualized understandings of inquiry-based learning for their students and classrooms. Data drawn from interviews, observations of lessons and professional learning communities as well as teacher reflections are discussed to share episodes of struggles and successes which teachers faced as they enacted lessons, gathered evidences from classrooms, and the conversations and refinements that followed which helped teachers set realistic expectations, address problems and create contextualized professional knowledge. The episodes are discussed to highlight the role of the researchers, teachers, and students' voices in shaping teacher learning and helping teachers move towards inquiry-based practices. It is hoped that this presentation provides insights of how a school develops teacher champions with contextualized understandings of ICT-mediated, inquiry-based learning for Science to lead and sustain changed practices.

Keyword: Curriculum & Pedagogical Innovation, Professional Development

Building an evidence-base for teacher education: Findings from a longitudinal study

Chairperson - Low Ee Ling, National Institute Of Education, Singapore
Teacher Quality, Teacher Learning and Development

Integrative Summary

Locally and internationally, longitudinal studies that track student teachers' professional development from pre-initial teacher education (pre-ITE) to ITE, and into their first few years of teaching are lacking. To plug this gap, this research project undertaken at the National Institute of Education (NIE) represents a first step to building an evidence-base for the continual review and enhancement ITE and early career teacher professional learning and development (TPL&D) within Singapore. This longitudinal study investigates the impact of ITE programmes and subsequent TPL&D on teachers' development of professional competencies and identities. We track student teachers' teaching and learning experiences from pre-ITE (e.g. contract teaching, relief teaching) to ITE (e.g. ITE courses, practicum) and into their 1st and 2nd years of teaching (teaching experiences and professional development). This study adopts both a cross-sectional and a longitudinal design. Main research methods include surveys via an online platform and individual face-to-face semi-structured interviews. Specifically, four cohorts of student teachers doing a Bachelor of Arts in Education or a Bachelor of Science in Education (BA/BSc (Ed)) degree at NIE were each surveyed and interviewed once, typically at the end of their year of study (July 2010, July 2011, July 2012, and July 2013 intakes). A cohort (July 2012 intake) of Postgraduate Diploma in Education (PGDE) student teachers at NIE were studied in their first two years in schools. They were surveyed and interviewed four times: when they entered and exited the PGDE programme (Phase I study), and during the 1st and 2nd years of teaching (Phase II study). We also interviewed the school leaders and middle managers of those BTs who participated in our interview sessions during their 1st year of teaching. Each of the four presentations focuses on one of the following four areas respectively: 1) student teachers' choice of teaching as a career; 2) BTs' development of professional competence from pre-service to the first two years of teaching; 3) challenges that BTs faced and support that they received; and 4) factors that have a positive impact on BTs' professional development.

Abstract 1

Why choose teaching: Triggers and drivers

Hui Chenri, National Institute Of Education, Singapore
Low Ee Ling, National Institute Of Education, Singapore

Why people choose teaching as a career has attracted the attention of many researchers. However, prior research on teaching motivations have largely explained this issue from the tripartite perspective (i.e. intrinsic, altruistic and extrinsic motivations). Some recent studies have adopted the Factors Influencing Teaching Choice (FIT-Choice) framework to investigate teaching motivations. However, almost all studies that adopted this framework as the theoretical basis were quantitative, and they made no attempt to distinguish socialisation factors and other factors on the motivation to teach. The present study builds on and extends the FIT-Choice framework, with qualitative evidence from the Singapore context. We make a conceptual distinction between the socialisation factors (triggers) and the other factors (drivers). Data were from the interviews with 26 student teachers doing a Bachelor of Arts in Education or a Bachelor of Science in Education (BA/BSc (Ed)) degree at NIE. The results highlighted the differences between the "triggers" and the "drivers", as well as the inter-relatedness between them. Some practical implications are drawn for teacher education both within Singapore and internationally.

Note:

This presentation reports findings of a paper entitled "Teaching as a career choice: Triggers and drivers", which has just been accepted by the Australian Journal of Teacher Education.

Abstract 2

Development of teacher professional competence: From pre-service to first two years of teaching

Low Ee Ling, National Institute Of Education, Singapore

Seetha Lakshmi, National Institute Of Education, Singapore

There is no denying that teachers need to possess sound professional competence and to grow their expertise throughout their career. However, longitudinal research on how teachers grow in the development of their professional competence is scarce. This longitudinal study investigates how pre-service teacher education programme and early career experiences impact teachers' development of professional competence. A cohort of student teachers from the Postgraduate Diploma in Education (PGDE) programme at NIE were tracked from programme Entry to programme Exit, and tracked during their 1st and 2nd years of teaching. Survey results showed statistically significant increase in student teachers' perceived levels of key professional competencies from programme Entry to programme Exit, including pedagogical content knowledge (PCK), classroom management, use of ICT in teaching, and reflection. On the other hand, the competencies acquired in their pre-service programmes remains fairly stable even after two years of teaching. However, sense of self as a teacher (e.g. perceived joy and pride in being a teacher, intention to stay in the teaching profession) have dropped significantly from Entry to Exit point, and to their first year of teaching. These results suggest that it is important to attend to the affective and emotional well-being of teachers, and efforts are needed to retain teachers. Future research can investigate whether a programme of a longer duration would bring more gains in teacher competence development, or novice teachers could be tracked for a longer period of time to examine the changing levels of teacher motivation and professional competencies.

Abstract 3

BTs' Challenges and school support that they received during the first two years of teaching

Cheong Beng Cheong, National Institute Of Education, Singapore

Lim Kam Ming, National Institute Of Education, Singapore

Many studies have showed that the first few years of teaching can be challenging for beginning teachers (BTs). This study explores BTs' teaching experiences during their first two years in schools, with a focus on the challenges that they face and the support they receive. Data were collected via individual face-to-face semi-structured interviews with 10 school leaders (SLs, principals or vice principals), 12 middle managers (MMs, heads of department (HODs) or School Staff Developers (SSDs)), and 16 BTs from 16 Primary and Secondary schools in Singapore. Findings revealed that challenges identified by the participants included classroom management, time management, working with parents, etc. Support BTs received from the schools include school orientation, pedagogical and socio-emotional support from the mentors and buddies, off-loading, mentoring programmes and courses, etc.

Abstract 4

Contributing factors to BTs' professional growth

Cai Li, National Institute Of Education, Singapore

Ng Pak Tee, National Institute Of Education, Singapore

This study aims to identify elements that can positively contribute to beginning teachers' (BTs) professional development during the first two years of teaching. Individual face-to-face semi-structured interviews were conducted with school leaders (SLs, principals or vice principals), middle managers (MMs, heads of department (HODs) or School Staff Developers (SSDs)), and BTs from 16 Primary and Secondary schools in Singapore. The narrative accounts of three groups of participants provide us with a more informed picture of how BTs grow professionally in their early career. Results showed that for BTs to be more successful, all three factors need to come into play: a supportive school environment, a well-structured support and mentoring system, and BTs' personal attributes (e.g. willingness to learn, a positive attitude). These findings have implications on how schools can better support and mentor BTs, and underscore the importance of BTs' acceptance of support and personal attributes in contributing to their professional growth.

Keyword: Mentoring, Teacher Education/Development

Games for Learning in Singapore classrooms: From Design to Desired Learning

Chairperson – Dr Matthew Gaydos, SUNY Korea, Korea (South)

Discussant - Victor Lim Fei, Ministry of Education, Singapore Learning Sciences

Integrative Summary

Interest driven groups in relation to games for learning are progressively crystallizing in Singapore schools. For engaging students in the development of relevant future-ready competencies, researchers, practitioners and policy makers are investing resources to understand and enact game-based learning (GBL) in Singapore classrooms (Jamaludin et al., forthcoming). However, despite teachers' eagerness in designing classroom games as means of engagement in desired outcomes of education, the endeavour is a sizeable pedagogical challenge that needs to accommodate the particularities of the school, teachers and students (de Freitas, Ott, Popescu, & Stanescu, 2013). The domain of teacher-designed games for learning remains challenging in terms of meeting 'deep' learning goals (Fullan & Langworthy, 2013) that are both content-mastery and process-skills oriented. Yet it does not signify that teachers' role as designers are superfluous (Lim & Barnes, 2002), rather the dimension of teachers as designers of effective learning environments (Ministry of Education, 2016) becomes increasingly pivotal against an ecological backdrop of sustainability and impact to learning (Hung, Jamaludin, Toh, 2015; Looi, 2013). Within this vein, we recognize that students' deep learning as afforded by games require a broader ecological outlook that do not only need a careful consideration of constructed pedagogies where game design mechanics foreground the desired content mastery and 21st century dispositional skills (e.g. evidence-gathering, perspective thinking; empathy), but also a distributed consideration of the agency and competency of the teacher-educator for sustainable implementation of game based pedagogies in the classroom, and an enabling ecosystem(s) (Barab & Roth, 2006). In this symposium, we draw on dual threads of teacher-educator driven game design and students' game-afforded learning, through a presentation of three locally designed games instantiated within the context of Chemistry (Valence), Geography (Sovereign City), and History (Singapore Surrenders!). These games are co-designed by local secondary school teachers and NIE lecturers/researchers. Through foregrounding evidence-based research on the use of designed games in classrooms, this symposium aims to delve into i) critical design aspects of constructive game play; ii) importance of students' deep learning emanating from effectively designed games, and iii) impactful and sustainable use of games as effective environments for developing future ready learners.

Abstract 1

Maximising Learning through Teacher-Designed Game: Can Game-based Learning Impact the Integrated Programme Students' Geography Results?

Ms Michele Tang, Catholic High School, Singapore

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This mixed methodology study sought to determine the effect of game-based learning on the geography test results of the Year 1 students in the Integrated Programme and to gain insights into the experimental group students' perceptions about game-based learning in geography lessons on Energy. Two classes of 60 students took part in this study. For the causal component, 30 students in one class were assigned as the experimental group and the other class of 30 students served as the control group. Data for this study were collected through pre- and post-test of the 60 students and a questionnaire survey of the 30 students in the experimental group. We found that the control class outperformed the experimental class for the causal component of our study. The experimental group students thought that the purpose of playing the card game was to enable them to acquire content knowledge. They learnt knowledge and skills related to Energy because of the fun element in the game, the design of the game, the interaction with co-players and playing the game many times. The majority of the students also perceived playing the card game as having helped them to improve their test results even though they did not perform as well as the control group in the geography post-test.

Abstract 2

Enhancing student interest and conceptual understanding in Chemistry through Valence gameplay

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Mr Tan Chin Guan, Kent Ridge Secondary School, Singapore
Mr Chew Ying Chao, Kent Ridge Secondary School, Singapore
Mr Wong Wai Kit, Kent Ridge Secondary School, Singapore
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This game-based learning (GBL) project investigated a learning approach that linked classroom activity to game play by way of preparation for future learning. The study explored the nature or qualities of the educational experience that a teacher-designed card game named Valence provided. Valence is a chemistry game based on atomic structure, which helps to introduce the students to the concepts of groups in the periodic table, electron exchange in ionic bonding, and the stable octet structure of atoms. In particular, the study investigated the possibility that a game could present players with a model that players could use to make sense of target content, and the ways of how game activities could infuse with classroom instructional design. To these aims, students from five local secondary three classrooms played the game Valence as part of their Chemistry learning. Data was collected to assess the development of their conceptual understanding as well as to understand students' interest and motivation towards learning as derived from their gameplay experience. A mixed methods analysis was conducted from the data gathered which included i) a pre and post conceptual understanding test, ii) survey instrument on students' interest and motivation, and iii) students' focus group discussion. Findings from this research endeavour will be discussed in light of students' learning in Chemistry and we will draw implications for future learning that is relevant for 21st century education.

Abstract 3

Singapore Surrenders! Game Design to Support Historical Thinking and Conceptual Development

A/P Mark Baildon, National Institute Of Education, Singapore
Dr Matthew Gaydos, SUNY Korea,, Korea (South)
Suhaimi Bin MOHAMED AFANDI, National Institute Of Education, Singapore
Dr Ivy Maria Lim, National Institute Of Education, Singapore
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Mr S N Chelva Rajah, National Institute Of Education, Singapore

The history game Singapore Surrenders! was developed as part of a larger project aiming to design rich instructional tasks that promote understanding of core historical concepts and develop historical thinking skills. In particular, Singapore Surrenders! was designed to support students' thinking about chronology, significance and causation in an interactive game environment to learn about the surrender of Singapore during World War II. In this session we will highlight the development of the game (involving collaboration - and play - among a group of historians, history education specialists and game designers), two core ideas undergirding development – that all learning is social and that learning history hinges on understanding 2nd order concepts (Afandi, 2013), key game design principles that shaped game development, and the game's implementation in an undergraduate course on Singapore history and a Secondary History classroom. Initial findings from the undergraduate History classroom suggest that the game fostered a high level of interaction with students asking each other questions about key events in history, deliberating about chronological order, and using spatial logic to consider the sequence of events. Data from the Secondary History classroom will be collected and analyzed to share initial findings. In the Secondary classroom, the game will be used in three different ways, with each game play targeting different conceptual understandings – chronology, significance and causation.

Keyword: Learning Sciences

Developing Lower Secondary Science Students' Argumentative Skills: Insights From a School Research Partnership Project

Chairperson - Dr Azilawati Jamaludin, National Institute Of Education, Singapore
Science Education

Integrative Summary

This symposium comprises a series of presentations involving an intervention project that leverages on close partnership with two secondary schools in Singapore. The overarching goal of this project is to design and implement learning tasks and instructional approaches that seek to develop lower secondary science students' argumentative skills. Engaging students in scientific argumentation is increasingly recognized as a crucial component of science education. However, it is a complex scientific practice that entails the acquisition and coordination of multiple knowledge and skills on the part of students. Supporting students in this quest also entails the development of new knowledge, skills and mindset on the part of science teachers. Such a developmental process can be facilitated by working in close partnership with school teachers in both the design and implementation process. For the purpose of this symposium, we bring together the voices of the teachers and researchers who participated in this collaborative project to provide multiple perspectives and insights gained from this partnership.

The first presentation provides an overview of the design of the learning tasks and pedagogy adopted for the intervention. The next two presentations illuminate the actual enactments of the learning design by offering insights into the learning outcomes and the experiences of the teachers who implemented the intervention. Finally, our last presentation looks ahead by reflecting on how our learning design can be further refined through taking on board student voices in the form of student interview data.

Abstract 1

Impetus and design of a pedagogical innovation to develop scientific argumentation

Seah Lay Hoon, National Institute Of Education, Singapore
Dr Azilawati Jamaludin, National Institute Of Education, Singapore
Frederick T. Talaue, National Institute Of Education, Singapore

Shifts in the educational landscape require innovative teaching techniques that facilitate the development of 21st century skills such as critical thinking and argumentation competencies. In science education, recent reforms have moved towards closer alignment with authentic science practices (NGSS Lead States, 2013), such as through scientific argumentation which has been increasingly viewed as a "core epistemic practice to engage young people with the workings of the scientific enterprise" (Bricker & Bell, 2008, p. 474). Yet, several studies have documented students' lack of ability to verbalise and construct scientific explanations that can clearly illustrate their understanding about certain scientific phenomenon or principle (e.g., Felton & Kuhn, 2001; Sandoval et al., 2014). Our research project aimed at the development of a pedagogical innovation that attempts to re-align science teaching at the lower secondary school level to more recent reform emphasis on scientific argumentation. We designed learning tasks that integrates written argumentation with conceptual instruction on three General Science topics – Heat, Chemical Changes, and Ecology. Our instructional model follows three progressive phases, namely Task Introduction, Conceptual Instruction, and Argument Writing. In this presentation, we describe these various components of the intervention design and highlight their theoretical underpinnings. Our pedagogical approach follows a guided inquiry format (Magnusson et al., 2002) with a high demand for metalevel reflection and follows a delayed conceptual instruction principle (Kapur & Kinzer, 2009; Schwartz & Martin, 2004). We discuss the Claim-Evidence-Reasoning (CER) framework (McNeill & Krajcik, 2012) that was adapted to structure students' arguments individually and collectively in groups, and embedded in an extended argument curriculum (Kuhn, 2010). In addition, we will share the various pedagogical supports that were integrated to foster students' engagement in the science practice of argumentation.

Abstract 2

Use of CER framework for constructing scientific arguments

Jocelyn TEO Ching Fang, Tanglin Secondary School, Singapore
Anglie, NG Sor Ling, Gan Eng Seng Primary School, Singapore

In this study, we share findings from a collaborative research project that seeks to develop lower Secondary Science students' critical thinking and scientific argumentation skills that will enable them to engage in coherent and productive dialog on scientific phenomena. Two classes were involved in the study. One class was involved in the intervention while the other class served as the control class. The experimental class was involved in three cycles of intervention during which a different learning task was used for each cycle. The three learning tasks concerned the topic of heat and temperature, chemical changes and ecology. To capture the students' conceptual learning at the end of each topic cycle, students in both classes undertook a pre-test and a post-test on the topic. The pre- and post-tests sought to capture the level of conceptual learning during the intervention. This data source provides a form of check to ensure that students' conceptual learning would not be comprised as they undertake an innovative learning process that aims to develop their scientific argumentative skills concurrently as they learn the content of a new topic. In the second cycle, a web-based platform was incorporated into our implementation. Through the use of this technology-mediated science argumentation platform, we document how the intervention program i) promotes visible thinking by scaffolding student's thinking, ii) help students document their thinking in a systematic and logical way through the use of a Claims-Evidence-Reasoning (CER) framework, and iii) prepare students for data-based questions at higher levels of Science learning. For the purpose of presentation, we analyzed student artefacts, the pre and post tests and the students' feedback. Through a mixed-method analysis of students' pre and post-tests (using T-test), artefacts and feedback (through content analysis), we discuss the positive learning gains arising from this work, as well as challenges faced that can be pointers for further improvement.

Abstract 3

State Your Claim: C-E-R Framework in Lower Secondary Science

Katherine, LI Peishan, St. Margaret's Secondary School, Singapore
KOK Lin Jin, St. Margaret's Secondary School, Singapore

The aim of the study is to develop students' competencies in scientific argumentation and critical thinking in the learning of lower secondary science through the use of real data and authentic situations. One class of students participated in the intervention and their performance was compared against another class which served as the control group. This presentation reports on the results analyzed from our first round of implementation. To develop students' argumentative skills, students in the experimental class adopted a learning task that required them to select from among four different measures for controlling mosquito population to reduce the spread of dengue infection for the chapter on Ecology. Throughout the topic unit, students were engaged in purposeful scientific argumentative discussions and tasked to use the C-E-R (claim-evidence-reasoning) framework based on Toulmin's Argument Pattern to craft claims, select suitable evidence and develop reasoning using information from sources such as scientific journals and newspaper articles. A pre-test and a post-test on Ecology were conducted on the experiment and control groups to assess conceptual learning in the context of learning scientific content in conjunction with learning scientific argumentative skills. Using paired T-test for pre and post-test, at p value=0.05, we can conclude that there was a significant improvement in the experimental group that was not observed in the control group. In addition to the learning gains, we will also share the challenges encountered by teachers and students during the implementation process from the teacher's perspective.

Abstract 4

We Hear You: Gaining Insights from Students' Voices for Future Directions

Frederick T. Talaue, National Institute Of Education, Singapore
Buana Sandila Putra, National Institute Of Education, Singapore

In this study, we seek to hear student's voices on their personal experiences with the designed argumentation-based learning tasks. It is normally expected that students who engage in argumentative discourse in science for the first time will face some cognitive challenges. But we can also imagine that in this new learning context students will encounter some shifts in their relations with the teacher and their peers, as well as with ways of knowing and doing science. We interviewed four students from a school that implemented the Ecology module, and

seven students from another school that took up the Chemical Changes module. Audio and video recordings were transcribed and analyzed through thematic coding. Also included in the analysis were student responses to an online survey that was conducted at the end of each module implementation. We were interested in the similarities as well as differences in students' personal accounts of the innovative pedagogy, particularly with respect to their feelings and appraisal of the learning tasks and their perception of the CER framework's utility for learning science. Not only do the students' feedback and insights provide us a partial assessment measure of the initial implementation cycles, they also help us anticipate improvements to future iterations of the teaching approach. In this presentation, we report our findings on students' sense of competency in engaging in argumentation, their views on science learning, and what they perceive as affordances and constraints of cooperative work embedded in the learning design, among others. From these findings we draw insights that could help us map critical adjustments to subsequent iterations of the learning cycles in order that students could reap greater benefits.

Keyword: Classroom Research, Science Education

Improving Second Language Extra-Curricular Activities

Chairperson - Peter Carter, Kyushu Sangyo University, Japan

Discussant - C. Jeff Anderson, Kyushu Sangyo University, Japan

Language and Literacy Education

Integrative Summary

As graduate schools and employers demand ever more from applicants, extra-curricular activities (ECAs) are increasingly used to differentiate candidates. For this reason, many higher education systems now insist it is imperative for tertiary-level students to participate in ECAs in order to show that their skills go beyond the merely mechanical. However, simply taking part is not necessarily sufficient; for participants to get the maximum benefit, it is important that the ECA is successful in providing enriching experiences.

For students majoring in a second language, effective ECAs are the nexus of language, learning, and culture. During the symposium, we focus on aspects that contribute to the success of such extra-curricular projects, including linking course aims to activities, designing effective feedback processes, and creating an environment in which outside experts and invited guests can work productively with students.

A common scenario in second language extra-curricular activities is that gaps in age, perceptions of status, and interests between the students and their regular teachers create a barrier to maximizing the potential impact.

Invited guests not only improve the numerical balance of the event, but can also act as a conduit between instructors and students. While the first paper in the symposium tackles the connection between theory and practice, the second paper provides insight into the under-researched area of the interplay between guests and organizers and guests and students.

The English Communication program at Kyushu Sangyo University runs up to five ECAs per year, and the symposium tries to draw on this experience as it brings together theory, practical issues, and the voices of organizers, guests, and students. As such, the papers we present share the aim of improving the effectiveness of tertiary level second language ECAs.

Abstract 1

Theory and practice of extra-curricular activities in second language contexts

Peter Carter, Kyushu Sangyo University, Japan

Extra-curricular activities play an increasingly important role in tertiary education and can, in fact, have a decisive role in determining students' post-graduation results. By the time students graduate, it is common for them to have taken part in internships and volunteer positions, and they must be able to demonstrate soft skills in addition to the technical ones related to their major.

For second language learners, the situation is even more acute. Proficiency in the target language is no longer considered sufficient by employers. Graduating students need to show that they have gained practical experiences using the language in real world contexts. The purpose of this paper is to show how, in its program for second language learners, one tertiary institution has created a series of extra-curricular activities (ECAs) ranging from a generalized first year field trip to more specific events such as an internship preparation course and a presentation skills boot camp.

Starting from a theoretical curricular-interactive model of ECAs, we will move on to issues such as common problems in implementing effective activities and offer solutions from our own programs. We will then give concrete practical examples of methods that have worked for us over a number of years, including tasks that work well outside of language classrooms, systems for garnering useful feedback, and ideas for linking lessons before and after the ECA is held in order to maximize its impact.

The paper will conclude with examples of both positive and negative feedback collected from participants at the end of each ECA and also prior to their graduation.

Abstract 2

Always the bridesmaid: The importance of guest teachers in extra-curricular L2 education

Lucas, Kyushusangyo University, Japan

Extra-curricular activities are an important part of a student's formative experience in higher education, and programs put a lot of energy into creating and managing these opportunities for students' benefit. One often overlooked feature of extra-curricular programs is the role played by guests invited to take part in the activities. Guests serve to increase students' motivation, add novelty and excitement to the events, provide impartial judgements on student performances, and create contexts for meaningful communication.

A further benefit of inviting guests to extra-curricular activities is that they can provide an external perspective to the organizers. In the case of second language (L2) learning, guests are often close in age and interests to the learners, and there is less of a status gap between learners and guests than there is with regular teachers. Furthermore, as guest teachers tend to perform this role a number of times and in different programs, they develop a skillset that regular teachers may not have. Making best use of their skills is one dimension in improving extra-curricular activities.

The purpose of this paper is to highlight best practices for extra-curricular education from the perspective of an experienced guest at tertiary level second language events. The presenter aims to raise awareness of the potential for closer involvement between organizers and guests, and will provide suggestions on how to maximize opportunities for second language learners to benefit from their extra-curricular experiences.

Keyword: Higher Education, Language and Education

Understanding the Work of Yayasan Mendaki and Charting New Narratives of Malay Achievement in Education

Chairperson - Aidaroyani Adam, Yayasan MENDAKI, Singapore

Discussant – Jason Tan Eng Thye, National Institute of Education, Singapore

Others

Integrative Summary

This symposium consists of 3 presentations which aim to help participants understand the work Yayasan Mendaki has been doing for 35 years as the first self-help group to be set up to uplift the educational achievements of the Malay-Muslim community.

The first presentation takes a look at the ways in which the media and academia have represented Malay underachievement and will propose new ways in which new analytical tools maybe harnessed for new ways of explicating this 'Malay problem' in education.

The second presentation will speak to the various macro issues Mendaki grapples with and the new narratives it want to work on for and with the community, using a 4-pronged approach.

The last presentation is a closer look at the Ethics of Care pedagogy that all Mendaki tutors are being trained in and the reasons for such a pedagogy, and the cultural change it seeks to engender.

Abstract 1

Yayasan Mendaki and the various narratives of Malay underachievement

Mardiana Abu Bakar, National Institute Of Education, Singapore

Yayasan Mendaki was the first community self-help group formed in Singapore. Post the 1980 census results, Malay/Muslim leaders realised that the community was not performing well in education and was lagging behind in their socio-economic progress. Mendaki was set up in 1982 and from the beginning, focussed its efforts on education via its tuition centres. Over the years, more than 200,000 students have gone through the Mendaki tuition scheme.

But has the Malay Muslim community seen gratifying results? While the community has seen vast improvements in educational performance and attainment, the passing rate of the Malay Muslim students remains generally lower than that of other ethnic groups for national examinations like PSLE, GCE 'O' level and 'A' level. Malay-Muslims students who further their education and go on to post-secondary education is also still much lower than that of other ethnic groups. Beyond that, the Malay Muslim community is also overrepresented in the lower income strata of the Singaporean society (Department of Statistics Singapore, 2015).

The visibility of the educational under-performance of Malay Muslims relative to the achievements of the Chinese and Indians has led to the racialisation of this issue. The ideology of meritocracy has reinforced the State's racialisation while standardised national examinations creates the display of equality and fairness. The blame of not doing well falls onto the individual and is constructed as an ethnic issue.

This presentation will firstly trace the various ways in which the 'Malay problem' in education has been represented since the 1980s in the media and in academia. It will then propose how the more useful analytical tools of socio-economic class, working class identities and the structural limitations of our education system must be added into ways of understanding Malay underachievement. The presentation will also look into how Mendaki may harness and have begun to work with new narratives to carry on its continuing endeavours to uplift the community.

Abstract 2

Realising the 'Signature Care Pedagogy': Mendaki's Journey in Championing Positive Learning Narratives

Sabrena Abdullah, Yayasan MENDAKI, Singapore

Yayasan Mendaki has run its tuition scheme for low income Malay Muslim families since 1982. This paper will take a look at the work that Mendaki has undertaken for 35 years and advocates a rethinking of a new success narratives by reinforcing the importance of positive education. Indicators such as progress in national examinations and increased representation of Malay Muslim students in post-secondary institutions over the last decade are encouraging milestones of social mobility. Despite improvements, Malay performance in national examinations consistently lags behind other ethnic groups. But evolving socioeconomic and educational realities call for continuous evaluation and innovation. MENDAKI's initiatives must continue to cater to the sizeable percentage of underperforming Malay Muslim students at the lower and lowest socio-economic strata of the community – where the reported monthly household income per capita of majority of Malay households (18.9%) is at \$1000 -\$1499, as compared to the national mode (12.4%) of \$6000 and over (General Household Survey, 2015). MENDAKI has chosen not to solely focus on academic measurements as the primary determinant of educational success for its students. It is sending out the crucial message that educational success ought to be broadened as the effectiveness and ability of strong, mutually reinforcing relationships between student, parent, community and schools to not only ensure school success but also positive life-long learners' identity to help these students get and stay in good jobs.

The development of a 'Signature Care Pedagogy' consists of four core constituents:

1. The Ethics of Care
2. MENDAKI-Home-School Partnership
3. Cultivation of Learning Families and Parental Education
4. Early Years Public Education and Outreach

In each of these constituents, the Pedagogy is aimed to empower parents and educators with appropriate pedagogical techniques in engaging students, particularly from disadvantaged families, to be positive learners; to value-add, and provide the community with resources. This paper will provide the success narratives and case studies of MENDAKI Tuition Scheme (MTS) and its other programmes.

Abstract 3

The Mendaki Tuition Scheme and its current development of a Pedagogy of Care framework

Mardiana Abu Bakar, National Institute Of Education, Singapore
Sharifah Fairuz Alsagoff, Yayasan MENDAKI, Singapore
Siti Khadijah Setyo, Yayasan MENDAKI, Singapore
Filzah Amalia Rahmat, National Institute Of Education, Singapore

Academics refer to private tuition as 'shadow education', a reference perhaps to the fact that such supplementary tutoring only exists because the mainstream education exists. Within Singapore's competitive education system, private tuition has been negatively perceived. This billion dollar industry as it is seen as potentially exacerbating the stratification between Singapore's rich and poor. Students who receive private tuition disproportionately come from those who are already advantaged and tuition has become such a panacea that even the brightest children undergo tuition. About 97 percent of Singaporean students are found to enrol in tuition classes.

The Mendaki Tuition Scheme (MTS), which was set up in 1982 by self-help group Yayasan Mendaki, is however, an anomaly within Singapore's shadow education phenomenon. MTS provides highly-subsidised tuition programme for the Malay-Muslim community. It runs over 50 centres for students from Primary 1 to Secondary 5. Every year, more than 9,000 students are registered in MTS. Students in MTS come largely from disadvantaged background. Over the years, MTS has been a valuable tool to improve Malay academic underperformance and to help Malay-Muslims acquire a higher chance of social mobility.

This paper will analyse MTS' recent particular effort in putting together a Pedagogy of Care that goes beyond looking at 'tutoring' towards building a culture of ethical and reciprocal care for learning, knowledge and self among tutors, students and parents of MTS. The Ethics of Care (EoC) framework, derived from the work of educational philosopher Nel Noddings, has been adapted for MTS' purposes towards a contextualised Care Pedagogy involving all stakeholders. The pilot for the project was started in September 2015 with mass training for tutors at two MTS centres. Classroom observations were also carried out and two EoC Seminars convened. The paper will share the challenges of initiating a culture change through this pedagogy.

In addition, this presentation will also outline the paradigm, rationales, ambitions and hopes of this pedagogy and the cultural change it hopes to engender in the Malay-Muslim community, a community that is seen as still playing catch up in a highly-achieving education system.

Keyword: Ethnicity, Professional Development

The arts: New directions for creating opportunities in curriculum enhancement and community participation for individuals with special needs

Chairperson - Dr Esther Joosa, Arts of the Earth Learning Hub, Singapore

Discussant - Liu Yonglun, National Arts Council, Singapore

Special Needs Education

Integrative Summary

This millennium has heralded increased dialogues about the value of the arts in community outreach and meaningful curriculum design for individuals with special needs. The values of the arts in special education, albeit from different perspectives, are increasingly recognised. Although the arts and special education in Singapore is a relatively recent phenomenon, this millennium has brought new directions. The role the arts in enhancing the lives of persons with special needs finds growing calls to give entry to people with a disability as active participants within the community of art practices. This has its effect on art education for individuals with a disability in Singapore, but also on opening public spaces such as museums. People with special needs are now recognised as makers and audiences.

This symposium brings insights into the changes in the arts and its position in special needs education in Singapore. In 2012, the National Arts Council (NAC) as an active contributor to dismantling attitudinal barriers brought initiatives that recognize to individuals with a disability as meaningful producers of art. NAC introduced special education (SPED) Partnership Programme supports efforts to promote the use of the arts as a pedagogical tool in Special Education schools so that the arts can become more deeply embedded as an integral and integrated part of the overall school experience. With the growing recognition of the arts in special needs in Singapore the implementation and value of special education practices. The recent implementation of the visual arts toolkit as a shared initiative between MOE and NAC brought insights of how in situ-mentoring, reflective practices and dialogue enhanced the pedagogies of SPED arts educators.

The aim of this presentation is to present some of the developments of the teachers in the implementation of the Visual Arts Toolkit (VAT) and its role in building curriculum strategies. different ideas about literacy, community inclusion. The arts have a lot to offer for education and community participation of individuals with a disability. The symposium presenters offer different perspectives and provide ideas for future dialogue about the role of the arts in living and

Abstract 1

Creating Arts Collaborations: Access and opportunities to Arts Education in Special Education Schools and in the community.

Yazid Eunos, Rainbow Centre - Yishun Park School, Singapore

Bibi Halimah Abdul Kader, Tanglin School, Singapore

Nisha Arun, Lighthouse School, Singapore

JANNET BARLISAN DACUMOS, Lighthouse School, Singapore

In 2015, the close partnership NAC and MOE culminated in the publication of the Visual Arts Toolkit for SPED Schools, which contains exemplar resources and materials developed by seven SPED schools. These are valuable resources for SPED schools to draw inspiration to develop arts lessons for SPED students. In 2016, the toolkit was disseminated to teams of SPED teachers who attended the Visual Arts-in-Action Programme, jointly overseen by MOE and NAC. The Programme comprised workshops, consultations and try-out lessons to guide and support teachers in the implementation of the toolkit.

The presenters, representing some of the participating schools, will share key learnings from the Programme and how the implementation of the toolkit was applied in teaching and learning of visual art. The session will highlight how the teachers were supported in the development of customized art lesson to cater to their individual students' disability profiles. You will also get a glimpse into reflections on their individualization of the Visual Arts lessons and of how these brought a deeper understanding of their students' abilities.

Abstract 2

Changed perspectives on the (visual) arts in special education: Connections between culture, community and curriculum

Dr Esther Joosa, Arts of the Earth Learning Hub, Singapore

With a world that is in transition the arts provide opportunities and new ideas to re-establish bonds with marginalised communities such as students with special needs. What is needed is the development of ideas and theoretical perspectives that encourage opportunities for active participation in the arts and community engagement. This study features efforts to develop evaluation standards about the effect of the artist engagement and skills of teachers with children with special needs in Singapore. It features critical aspects about the development of meaningful art education programs and arts in community outreach.

Practices do not develop in a vacuum but require thought and dialogue about historical perspectives, social outlooks and understanding the effect of pedagogies and outreach practices. The earliest documentation of the role of culture and community in the arts in special education can be traced to published discussions in the 1920s. In Russia, the cultural-historical theorist Vygotsky rendered his thoughts about the role of integration into the social and cultural life of the community engagement (1993).

A principal focus of this study is the recent introduction of VAT and the role of social and cultural interaction and facilitation in creating a context for context competence. Issues such as teacher experiences, exposure and beliefs about artistic practices, skills and attitudes in nurturing artistic representation, and the value of the arts as a literacy practice were contributing factors to building practices (Barone & Eisner, 2012; Freedman, 2003).

Based on in situ video recordings, this study brought understanding of the relationship between the exposure of the educator and art practices. What developed was a focus on dialogue and reflective practices in art education in special needs that have the potential to reframe perspectives on the engagement of individuals with special needs in the arts.

Reflexive practices and mentoring brought awareness and improvements in the artistic performance and of the importance to encourage to explore ideas. Theoretical understanding of the nature of verbal interactions brought awareness of the application of socio-cultural theory and reflective practices to further improve pedagogy, practice and outcomes of artistic program content .

Abstract 3

Community Arts Education Partnerships: Developing Culture and Creativity through Collaboration in Special Education.

Wong Meng Ee, National Institute Of Education, Singapore

Art education impacts learners broadly from preschool and throughout life in various settings including schools, museums, community centres, hospitals through art therapy and higher education (Derby, 2012). For persons with disabilities, Lowenfeld, the father of Art Education", asserts art offers a creative avenue where children with disabilities can benefit from participation as well as remediation, rehabilitation, and socialization (Efland, 1990). Historically, art classrooms were among the first places for mainstreaming (Causton-Theoharis & Burdick, 2008) and is sometimes the best environment for some individuals with disabilities (Guay, 1994; Taylor, 2005). Increasingly, partnerships in arts education with public spaces, such as museums are an important contributing force in growing and sustaining long-term school arts programs that bring students, teachers and communities together. Building collective resources and support from the various partners augments the art education capability within the schools and offers a mutually benefitting relationship of all stakeholders that has its effect on community living. This presentation sketches the potential to extend existing arts partnership with special schools in Singapore with the views of people with a disability. With example of the visually impaired, it explores how greater support for arts education partnerships that include public spaces such as museums can develop social and creative capital among schools can begin from these partnerships. Suggestions are put forward to flourish the potential between public art spaces and artists with the special schools, the community and beyond.

Keyword: Arts & Music Education, Special Education

Conducting large-scale cluster randomised controlled trials in early childhood education and care settings

Chairperson - Tony Okely, University of Wollongong, Australia
Early Childhood Education

Integrative Summary

This symposium aims to describe methodologies from three large-scale cluster randomised controlled trials (RCTs) that have been conducted by researchers from Early Start, at the University of Wollongong, Australia. When combined, these RCTs involve around 160 early childhood education and care (ECEC) centres across the state of New South Wales. Each of the interventions requires the staff to re-think their pedagogy in areas of cognitive, social and emotional, and physical development of children in their ECEC centre. Researchers will provide a brief background to each study, including its design, and share experiences around recruitment (of centres, educators, and children), randomisation, intervention development, staff professional development, comparison conditions, selecting appropriate outcome measures, assessing cost-effectiveness, data collection, process evaluation, and statistical analyses. As each of these studies will have completed follow-up data collection by the time of the conference, researchers will share aspects of implementation and evaluation that have been successful and provide recommendations for those interested in conducting their own large-scale RCTs.

Abstract 1

Study 1: The Fostering Effective Early Learning (FEEL) Study

Marc de Rosnay, University of Wollongong, Australia

FEEL is a 18-month study that aims to evaluate the benefits of a professional development program for early childhood educators. It is a two-arm, parallel group, cluster RCT involving 90 ECEC centres in New South Wales, Australia, selected to ensure representation across the National Quality Standards (NQS) ratings, geographic location, centre type and socioeconomic status of areas. ECEC Centres were randomly allocated to an intervention or control group. Intervention centres received an intensive professional development intervention delivered in three distinct phases over a 9-month period. Phase 1 was a 2-day intensive PD, Phase 2 was 5 x rolling fortnightly half-day PD session, and Phase 3 involved blended online support building upon the earlier two phases. Control centres continued with their usual classroom practice. Primary outcomes, at the child level, were two measures of language development: verbal comprehension and expressive vocabulary. Secondary outcomes at the child level were measures of early numeracy, social development and self-regulation. Secondary outcomes at the ECEC room level were measures of environmental quality derived from full-day observations.

Abstract 2

Study 2: Jump Start

Tony Okely, University of Wollongong, Australia

Jump Start is a multi-component 18-month intervention which aims to promote ECEC-based physical activity and gross motor skill competence among children aged 3–5 years. It is a two-arm, parallel group, cluster RCT involving 43 centres, all located in areas of socio-economic disadvantage across New South Wales. The Jump Start intervention is based on Social Cognitive Theory and includes five components: a structured gross motor skill lesson (Jump In); unstructured outdoor physical activity and gross motor skill time (Jump Out); energy breaks (Jump Up); activities connecting movement to learning experiences (Jump Through); and a home-based family component to promote physical activity and gross motor skill (Jump Home). ECEC centres were demographically matched and randomised to Jump Start (intervention) or usual practice (comparison) group. The intervention group received Jump Start professional development, program resources, monthly newsletters and ongoing intervention support. Outcomes included change in total physical activity within centre hours (primary outcome), self-regulation, gross motor skill proficiency, weight status, bone strength, child temperament and approaches to learning, and educator and parent self-efficacy (secondary outcomes). Extensive quantitative and qualitative process evaluation and a cost-effectiveness evaluation were also conducted.

Abstract 3

Study 3: Get-Up – Dr Rute Santos

Rute Santos, University of Wollongong, Australia

Get-Up is a multi-component 12-month intervention that aims to assess the effects of reducing sitting time in ECEC centres on cognitive development among toddlers (14-26 months of age at baseline). Get-Up is a two-arm, parallel group cluster RCT involving 28 centres, located in areas of socio-economic disadvantage in New South Wales. The intervention is based on Social Cognitive Theory and includes professional development for educators, provision of resources and instrumental materials, follow-up support, and performance monitoring and feedback. The educators from intervention group received professional development on how to reduce total sitting time and bouts of sitting. The primary outcomes are children's cognitive development, assessed using the Bayley Scales of Infant and Toddler Development and executive function, assessed using the Early Years Toolbox. Secondary outcomes include sitting time, physical activity and sedentary behaviour, sleep, adiposity, blood pressure, retinal microvasculature, and bone mineral density. Process evaluation will include fidelity of the implementation, consistency of the implementation across ECEC services, and barriers to implementation.

Keyword: Early Childhood, Professional Development

Is working memory working everywhere?

Chairperson - Kerry Lee, National Institute Of Education, Singapore
Cognition, Motivation and Learning

Integrative Summary

Working memory refers to the mental workspace for processing and remembering information simultaneously. An example of working memory at work is mental arithmetic. When an arithmetic problem arises in everyday conversation, for example $28 + 16$, a problem solver first has to remember the numbers and the operations required. Depending on his or her facility with arithmetic, numbers in the ones position need to be either computed or retrieved from memory. The partial solution needs to be kept in mind, regrouped, and added to numbers in the tens position. Since Baddeley and Hitch's (1974) seminal paper on working memory, many studies have examined the role of working memory in classroom related activities. Although strong relations between working memory capacity and success in general mathematics achievement and reading comprehension tests have been found, there remains uncertainty regarding the extent to which working memory resources are needed in more specific instances of academic achievement. In this symposium, we present findings from three studies. The first study examined whether students' success with mathematical problems containing irrelevant information are related to their working memory and inhibitory abilities. The second study examined the role of working memory in the context of second language learning. The third study returns to children's inhibitory or ability to suppress interference from irrelevant and prepotent information. Focusing on mindfulness, the study focused on its relations with inhibitory ability, behavioural regulation, and academic achievement. The symposium will close with a brief review and description of current efforts to improve working memory capacity.

Abstract 1

Getting Primary 3 Students to Effectively Solve Misleading Math Problems: The Role of Working Memory, Inhibition and Math Knowledge

Jeremy Ng Lan Kong, National Institute Of Education, Singapore
Khng Kiat Hui, National Institute Of Education, Singapore
Kerry Lee, National Institute Of Education, Singapore

Students are known to make mistakes when solving math problems containing irrelevant information e.g., when there are irrelevant numbers. Students are also known to struggle when the relational terms in a word problem does not "match" the operation required to solve the problem e.g., when more than is present and subtraction is required. Success on these types of misleading problems are however important for preparing students to solve mathematical problems in the real-world.

We investigated the cognitive factors and math knowledge required for solving misleading math problems in a group of Primary 3 students ($N = 79$) attending two public schools in Singapore. The students were given tests of working memory and inhibitory abilities; and, we measured their math knowledge with a relevancy identification task and a computational fluency task. Students' performance on misleading math problems was assessed using two word problem-solving tasks. In one of them, they solved word problems that contained either numerical irrelevant or literal irrelevant or no irrelevant information; and, in the other, they solved word problems that contained either matched or mismatched relational terms.

We found that numerical irrelevant information was more detrimental to problem-solving accuracy than literal irrelevant information. Accuracy on problems containing mismatched relational terms was also poorer than on problems containing matched relational terms. Performance on the misleading problems was significantly associated with working memory and relevancy identification skills. Neither inhibition nor computational fluency was significantly associated with performance on the misleading problems.

Findings suggest that misleading math problems impose significant working memory demands on students and, the ability to sieve out relevant information is important for solving these types of questions. We discuss classroom strategies that teachers can use to get students to effectively solve those questions.

Abstract 2

Examining the L2-listening-working memory relationship

Matthew Wallace, National Institute Of Education, Singapore

An important cognitive factor influencing L2-listening comprehension is working memory (WM). WM is the limited-capacity memory system that serves as our temporary processing workspace and consists of two components: a storage subsystem that temporarily maintains information, and a processing subsystem controlling where new information comes from (shifting function) and what information is stored (updating function) (Baddeley, 2012). Although previous research has indicated that both subsystems together predict listening comprehension, it remains unclear how listening is affected by each WM component individually. A recent framework presented by Wen et al. (2013) suggests that performance aspects, like comprehension, are more influenced by processing than storage; something this study aimed to confirm. To do this, data from 230 Japanese EFL high school students were examined. Data sources included a listening comprehension test (TOEFL Junior Standard listening) and tests measuring the storage component and shifting and updating functions (based on Miyake et al., 2000) representing the processing component. Latent-variable analysis results supported Wen et al.'s framework, as shifting and updating predicted L2 listening, but storage did not. This finding suggests that accurately shifting attention and maintaining relevant information in memory contribute more to L2-listening comprehension than primarily remembering large amounts of information.

Abstract 3

Mindfulness Facets: How they relate to Inhibition, Behaviour Regulation, and Academic Achievement among Adolescents

Tan Bee Li, National Institute Of Education, Singapore

Mindfulness refers to the awareness that emerges through paying attention to the present moment in a non-judgmental manner. Mindfulness has been shown to be multifaceted in nature consisting of five facets: observing, acting with awareness, describing, non-judgment, and non-reactivity. Inhibition, a core executive function, has been theorized to facilitate the suppression of elaborative processing. This study aimed to investigate the relationship dispositional mindfulness and prepotent response inhibition, a particular type of inhibition involved in the suppression of automatic responses. Prepotent response inhibition was expected to facilitate acting with awareness, non-judgment, and non-reactivity through the suppression of automatic elaborative processing. This study also aimed to examine how dispositional mindfulness relates to behaviour regulation and academic achievement amongst adolescents in Singapore. A sample of 221 students (mean age = 12.75) were recruited from three local Secondary Schools. Participants completed four computerized tasks assessing inhibition, the Five Facet Mindfulness Questionnaire, and a self-reported measure of behaviour regulation. A purer measure of inhibition was derived using structural equation modelling (SEM). SEM was then used to investigate how mindfulness facets relate to prepotent response inhibition, behaviour regulation, and academic achievement. Contrary to expectations, inhibition was unrelated to any of the mindfulness facets. Acting with awareness, which captures the tendency to attend to one's primary activity, was strongly associated with behaviour regulation as a whole and with each of its components—monitoring, emotional control, impulsive control, and shifting. However, acting with awareness was more strongly associated with emotional control and the monitoring of one's action among adolescents who were more judgmental (critical) of their thoughts and emotions. This trend was also observed for behaviour regulation. The study found no support that mindfulness facets were associated with academic achievement, participants' PSLE grades. The results indicate that the suppression of automatic elaborative processing is not involved in mindful attention regulation. Findings suggest that mindfulness-based programs aim at improving behaviour regulation can focus on cultivating acting with awareness. This facet may be especially beneficial in improving emotional control and the monitoring of one's actions among adolescents who are judgmental of their thoughts and emotions.

Keyword: Cognitive Processes/Development, Psychology

Teaching Physical Education in Schools

Chairperson - TEO-KOH Sock Miang, Physical Education and Sports Teacher Academy, Singapore
Physical Education & Sports

Integrative Summary

This symposium will provide some insights for Physical Education (PE) teachers, school leaders and policy makers to consider how we can improve our current PE syllabus and pedagogical practices. A series of three presentations will be delivered by staff from the Physical Education and Sports Science Academic Group at the National Institute of Education, Singapore.

First, Dr. Chow Jia Yi will share how different pedagogical approaches (e.g. Nonlinear Pedagogy) can impact the teaching and learning of an invasion game. Interview data from teachers will also be presented to provide valuable insights to how Nonlinear Pedagogy can work in a school setting for practitioners.

Next, Dr. Swarup Mukherjee will present results from a project on Fundamental Movement Skill (FMS) proficiency in Singapore school children. Implications on policy making for both preschools and lower primary schools will be discussed, alongside with suggestions on how PE teachers can adapt the curriculum and learning outcomes according to the motor abilities and the FMS proficiency levels of children.

Last, Dr. Leng Ho Keat will explain the use of Foucault's archaeological lens to see how the epistemological structure of PE classes is shaped in primary school students. Employing semi-structured interviews, drawing-writing and drawing-telling techniques will provide sociological and methodological knowledge of interpreting primary school PE in Singapore and the results will contribute to the educational policy development.

Abstract 1

Nonlinear Pedagogy and its relevance for an Invasion Game: A Singapore Experience

CHOW Jia Yi, National Institute Of Education, Singapore
Chris Button, University of Otago, New Zealand
Clara Tan, Ministry of Education, Singapore
Benjamin Tan, Ministry of Education, Singapore
TEO-KOH Sock Miang, Physical Education and Sports Teacher Academy, Singapore
Manu Kapur, Education University of Hong Kong, Hong Kong
Corliss Choo, National Institute Of Education, Singapore

There is a constant search for the best way to deliver coaching or teaching in order to maximize skill acquisition. Increasingly, practitioners see the need to recognize the complex and dynamic interactions that occur between the individual, task and environmental constraints during learning. Nonlinear Pedagogical, underpinned by Ecological Dynamics, provides a suitable pedagogical approach to encourage exploratory learning that is student-centred and exploratory in nature. Key pedagogical principles relating to representativeness, manipulation of constraints, awareness of focus of attention instructions, task simplification and the functional role of noise can encourage exploratory learning that helps build 21st century competencies in our learners. Some preliminary results from a project that examined the impact of Nonlinear Pedagogy on the teaching and learning of an invasion game will be shared. Interview data from teachers involved in the intervention provided valuable insights to how Nonlinear Pedagogy can work in a school setting for practitioners.

Abstract 2

Fundamental motor skill proficiency of Singaporean lower primary school children

Swarup Mukherjee, National Institute Of Education, Singapore

Fundamental movement skill (FMS) proficiency is most successfully acquired during the elementary years. This cross-sectional study assessed the FMS proficiency in Singaporean children at the start of primary school and following 2.5 years of exposure to the primary school PE curriculum. Participants included a total of 244 children from primary-1 and primary-3 level. Fundamental movement skills (FMS) were assessed using the Test of Gross Motor Development-2 that includes locomotor (LOCO) and object control (OC) subsets. Most children had a rating

of 'average' and 'below average' for the LOCO skills while the rating was mostly 'poor' and 'below average' for the OC skills. No significant effect of gender was observed for both subsets and overall FMS proficiency. None of the FMS was mastered by all children. Singaporean children do not have age-appropriate FMS proficiency at the lower primary school level. This is a concern as lack of age-appropriate FMS proficiency can lead to low sports competence perception, difficulties in coping with the movement learning expectations and consequently reduced motivation to participate in the PE and play. Our results have strong policy implications for both preschools and lower primary schools. Structured movement development programmes focusing on process-oriented development of motor skills are necessary during these years. Special focus is necessary on OC skills and the movements that require muscular fitness like hopping and jumping. The physical educators need to adapt the PE programme and learning outcomes according to the motor abilities and the FMS proficiency levels of children entering the primary school and during the lower primary years.

Key words: children, fundamental movement skills, motor readiness, lower primary school, Singapore

Abstract 3

Using Foucault's Archaeological Lens to Examine Physical Education classes in Primary Schools

Chung Ho Jin, National Institute Of Education, Singapore

Leng Ho Keat, National Institute Of Education, Singapore

Park Chanmin, National Institute Of Education, Singapore

Introduction

Physical education is a subject that provides students with an opportunity to build confidence and relationships with others. In addition, it provides students with the opportunity to develop leadership, character and other skills. Fry and Tan (2005) have previously described how students perceive physical education in Singapore. However, according to Foucault's thoughts, a physical education class is a discourse that is constituted by surrounding people of a particular era (Chung, 2009). It is critical because it does not illustrate the past but rather re-write it from a present perspective (Lee, 2003). Foucault (1982) used the terminology, archaeology, to explain what is currently happening in addition to the conditions of discourse that existed then. It sets skills, rules and systems that comprise the knowledge in a certain environment at a certain time as evidence of social and discursive practice. Sheridan (1997) confirmed the belief that "discourse is not objects: rather, discourse constitutes them" (p.98). In the structure of discourse, it will be possible to figure out how educational policies have developed (Chung, 2013).

Methods

8 primary school students will be selected using purposive sampling method (Patton, 2002). Researchers will conduct semi-structured interviews which will be voice-recorded and transcribed. In addition, a writing-drawing and a drawing-telling method will be employed to further explore pupils' awareness and their experiences (Pridmore & Bendelow, 1995; Wright, 2010). Data would be analysed through Michel Foucault's archaeological discourse analysis. Archaeology reveals an overall structure of the ground by tracking a vein that is exposed in the geological strata. Likewise, Foucault's archaeological discourse analysis will examine the discourse structure of intricate social net by trying to understand why the present looks like how it looks like today (Chung, 2012).

Conclusion

By employing Foucault's archaeological lens to understand the discourse of primary school students in physical education classes, it will contribute to educational policy development.

Keywords: Discourse, Physical Education Class, Primary School Student, Archaeological Analysis, Foucault

Keyword: Discourse Studies, Physical Education

The State of Education and the Education State: Findings and Reflections from NIE's Core Research Programme, 2004-Present

Chairperson - Dennis Kwek, National Institute Of Education, Singapore

Discussant - Yew-Jin Lee, National Institute Of Education, Singapore
Educational Policies and Practices

Integrative Summary

The symposium describes, and provides insight into, state-of-the-art research into the nature of teaching and learning in Singapore primary and secondary classrooms over the last 12 years. Given the close coupling between economy and education in our nation state, our students need to be prepared, and look forward to, engaging in the opportunities brought about by political, social, cultural, and economic forces that are impacting on Singapore today and into the future. Education has to generate not only students who are ready for the future, but who can create a distinctive future for themselves and for Singapore. The various educational policy reforms and initiatives over the past two decades have been specifically directed towards these ends.

Like a barometer, systemic changes to the state of education requires a form of measurement and monitoring to ascertain whether changes are occurring, in what ways, and for whom. To this end, the Centre for Research in Pedagogy and Practice's Core Research Programme (CORE) began in 2004 with the purpose of providing a social science research evidence base to document the pedagogical shifts in primary and secondary classrooms across a range of subjects. The symposium comprises of three papers and 2 discussants. The first paper provides a historical overview of CORE and its methodological and research base, and how the suite of studies over the past 12 years inform each other, and the state of education. The second paper describes the implementation of the Primary 3 mathematics curriculum in a sample of Singapore classrooms and describes the challenges, tensions and opportunities for teachers as they implemented the new mathematics curriculum. The third paper describes the enactment of the Primary 5 and Secondary 3 science curricula in a sample of Singapore classrooms. Like the second paper, the focus is on curriculum enactment by teachers as they interpret the curriculum in similar and different ways in their specific classroom contexts. Finally, discussants include a senior science academic and a mathematics curriculum specialist as discussants that will provide insights and share their thoughts on the state of education and the implications for the education state.

Abstract 1

Disruption or Evolution: Using Systems Research to Bridge Research, Policy and Practice

Dennis Kwek, National Institute Of Education, Singapore

Disruptive technologies, globalization and localization, changing demographics and cultural shifts, increasing global political tensions, complex workplace and economy demands, these are some of the key driving forces of the future that will undoubtedly change the state of education in our Singapore schools. Educational policy reforms and initiatives since Thinking Schools, Learning Nation and Teach Less, Learn More have been specifically directed towards evolving or disrupting the education system towards the holistic development of new student and teacher identities, new forms of hybridic pedagogical repertoires that balance performative with knowledge-building pedagogies, and the supporting infrastructures to help schools improve continuously.

As one of the largest multi-level, multi-method, large-scale study mounted in Singapore schools over the past 12 years, CORE seeks to inform policy makers on policy effects, curriculum developers for curriculum reviews, teacher educators on areas of pedagogical improvements, and researchers on new innovations that can be mounted to strengthen the instructional core of Singapore teaching and learning. This paper describes the history and trajectory of CORE as it evolves over the years to become more relevant to the various stakeholders while at the same time remaining rigorous in its methodological and research base. The suite of CORE studies since 2004 have informed each other, and the state of education, with the intention to use systems level research to bridge research, policy and practice. The paper also critically engage with the nature of knowledge mobilisation as various stakeholders – researchers, policy makers, teacher educators - work together dialogically to engage with research knowledge for their own purposes. Future plans for CORE are described with an invitation to the symposium participants to provide inputs on how CORE can continue to inform policy, pedagogy and practice.

Abstract 2

When teachers implement with real students in real classrooms: The Primary 3 Mathematics curriculum in Singapore

Siti Hawa Jonid, National Institute Of Education, Singapore
Divya Bhardwaj, National Institute Of Education, Singapore

The study of teaching and learning in Primary 3 Mathematics classrooms illustrates how teachers interpret the curriculum through their beliefs and experiences as they interact with students and curriculum materials in the classroom. The curriculum is what is taught and learned in schools (Kelly, 2004) and the syllabus a map and a descriptive overview of the curriculum (Luke, Woods & Weir, 2013). Our specific focus is on teachers' understanding, interpretation and enactment of the revised 2013 Mathematics curriculum. Based on classroom observations of 9 thematic 'units' of school curriculum work at the Primary 3 level (2015), transcripts of classroom talk, and data from teacher interviews and student focus group discussions, this presentation highlights the challenges, tensions, and opportunities for teachers as they implement the revised syllabus; and the attendant pedagogical changes in curriculum recontextualisation (Bernstein, 1990).

Teachers' classroom enactment shows effective use of the Concrete-Pictorial-Abstract approach: frequent and explicit connections across multiple representations focusing students on abstract concepts thus, ensuring they have something to "fall back" to when working in the symbolic mode (Bruner, 1966, p. 49). Typically, the lesson-level learning cycle shows Readiness to prime students before teachers move into the core teaching mechanism of Engagement followed by opportunities for students' Mastery. Occasionally, teachers refrain from diagnostic repair evident in one teacher's admission that she had to "keep on prompting and guiding them what to do." There is considerable evidence of school-specific Polya's problem solving heuristics but our findings confirm the "routinizing" manner in which problem solving is enacted in Singapore classrooms (Dindyal et al., 2012, p. 3), observable in a strong procedural focus in the looking back stage: "How can I check my answer?"

Additionally, this study yields valuable feedback to the Ministry by eliciting teachers' beliefs about Mathematics teaching, their awareness of and enactment of the revised curriculum; and through students' views and experiences in learning Mathematics. The findings have important implications for teachers' classroom practice and professional development, and highlight noteworthy aspects about development and refinement of the national curriculum, and personnel deployment. Based on the findings, we discuss some areas for improvement.

Abstract 3

Understanding and Researching Inquiry Teaching and Learning in Singapore Primary 5 and Secondary 3 Science Classrooms

Fatema Hussain, National Institute Of Education, Singapore
Dennis Kwek, National Institute Of Education, Singapore
Viktor Lim, National Institute Of Education, Singapore

The presentation describes a baseline investigation of ten Primary 5 and Secondary 3 Science teachers and their implementation and enactment of the Singapore science curriculum in their classrooms. The study addresses the research question: What are the relationships between instructional and pedagogical practices, the intellectual quality of knowledge work in the classroom, and the teacher pedagogical reasoning in Primary 5 and Secondary 3 Science classrooms. Drawn from extant literature on the nature of disciplinarity, we understand the intellectual quality of knowledge work to comprise of (a) the design and implementation of instructional tasks; (b) the structure and nature of classroom talk; (c) teachers' use of high-leverage instructional practices. Classroom observations, video lesson coding, teacher and student interviews were conducted and findings reported in this presentation. In particular, we describe our approach to coding Science lessons drawing from local curriculum intentions, international curriculum norms for Science, prior validated Core indicators, all centrally focused on the instructional core of teachers working and interacting with students in the presence of Science content.

We briefly compared our 2015-2016 dataset with data collected from 2004's Core 1 Research Programme to show the shifts in pedagogical practices that have occurred in the span of ten years, particularly the introduction of inquiry based teaching in Science. The presentation describes how a key strength of Singapore Science pedagogy is the balanced focus on factual, procedural and conceptual knowledge as teachers introduce and engage students

in scientific concepts and procedures, but such a tightrope act has incurred opportunity costs as teachers continue to work between institutional requirements of preparing students for the upper primary and secondary examinations, and disciplinary intentions of engaging students to learn the nature of science, and how to acquire scientific virtues and future-oriented competencies. The presentation ends with a discussion on John Dewey's key ideas on the scientific method and inquiry and how inquiry must not only be seen as experience-making, but inquiry "includes all of thinking, reflecting, judging, insight, feeling and imagination" (Johnston, 2002, 10).

Keyword: Classroom Research, Teacher Research

Assessing and fostering 21st Century Competencies (21CC) in Learners: Insights from a meta-synthesis of Singapore educational research

Chairperson - Jennifer Tan, National Institute Of Education, Singapore

Discussant - Dr. Sheryl Lyn MONTEROLA, University of the Philippines Diliman, Philippines
IT in Education

Integrative Summary

The past decade has seen a significant number of educational research projects undertaken by academics at Singapore's National Institute of Education that engages—either directly or indirectly—with the notion of educating for 21st century competencies (21CC). The foci of these studies can be broadly categorized as (a) the mapping of 21st century teaching and learning processes and outcomes across schools, programmes and system-wide, (b) the design and implementation of assessment and pedagogical innovations aimed at fostering 21CC in learners, as well as (c) the scaling and sustaining of such educational innovations across the system. Altogether, the projects saw the development of a substantial suite of curriculum innovation packages and new technology-mediated learning platforms that were trialed by as many as 20,000 Singapore students across a wide range of schools, year levels, and subject domains, alongside the conduct of more than 300 in-service teacher learning and professional development workshops.

This symposium offers a synthetic overview of key learnings gleaned from these research with the aim of expanding the extant local and international knowledge base on educating for 21CC.

The first paper highlights the spectrum of 21CC assessments that have been developed and validated in Singapore; and that measure or characterize cognitive, interpersonal, and intrapersonal 21st century learning dispositions and outcomes across disciplines. It also draws attention to a range of technology-enabled pedagogical innovations that were implemented in local schools and their corresponding impact on student learning experiences and outcomes.

The second paper discusses leveraging learning analytics (LA) for fostering 21CC in the Singapore curriculum. The paper elaborates on the automated and semi-automated data collection, analysis and visualization techniques enacted in the LA projects and how these were used to formatively assess 21CC and foster student-agentive and process-oriented learning.

The third paper brings to the fore pockets of excellence in Singapore schools that embed 21CC in STEM. It describes diverse learning contexts that give rise to these pockets of excellence; and identifies enablers and inhibitors of 21CC in STEM.

To close the symposium, discussant Dr. Sheryl Lyn Monterola will propose mechanisms and ways forward for creating more value in 21CC research.

Abstract 1

Innovating assessments and pedagogies for 21CC: Research learnings from Singapore

Jennifer Tan, National Institute Of Education, Singapore

Dr. Sheryl Lyn MONTEROLA, University of the Philippines Diliman, Philippines

Elizabeth Koh, National Institute Of Education, Singapore

Dr Jeanne Ho, National Institute Of Education, Singapore

The past decade has seen a significant number of educational research projects undertaken by academics at Singapore's National Institute of Education that engages—either directly or indirectly—with the notion of educating for 21st century competencies (21CC). Through this suite of studies, a substantial number and range of assessment and pedagogical innovations have been developed, implemented, validated and evaluated across a wide sample of student participants from different year levels and schools in Singapore.

This paper highlights the spectrum of 21CC assessments that have been developed and validated in Singapore. It identifies examples of objective tests, self-reports, frameworks, and learning analytics that measure or characterize

cognitive, interpersonal, and intrapersonal 21st century learning outcomes across disciplines. Considerations for developing and validating generic and disciplinary-specific tools will be underscored.

Moving beyond assessments, the presentation also draws attention to technology-enhanced learning and pedagogical innovations that were implemented in local schools and their corresponding impact on student outcomes. Analysis of these techno-pedagogical innovations revealed seven distinct pedagogical themes, namely, inquiry-based, student-generative, critical multiliteracies, computer-mediated problem solving, game-based, collaborative, differentiated and immersive. Challenges of technology-mediated pedagogies will be discussed.

Abstract 2

Leveraging learning analytics for 21st Century Competencies (21CC) in the Singapore curriculum: Current and future directions

Elizabeth Koh, National Institute Of Education, Singapore

Jennifer Tan, National Institute Of Education, Singapore

Dr. Sheryl Lyn MONTEROLA, University of the Philippines Diliman, Philippines

Learning Analytics (LA) offers rapid assessment of student outcomes that is valuable for showing evidence of students' learning trajectories and for informing teachers' pedagogical decisions. Data from LA is also a powerful information resource that can be used for knowledge acquisition, co-creation, self-directed learning, self-, and peer regulation, which are important 21st century learning mechanisms.

Our paper presents the initiatives of NIE projects funded by the Education Research Funding Programme and the eduLab Funding Programme that have leveraged LA for 21st Century Competencies (21CC) in the Singapore curriculum. We focus on projects that assess cognitive (higher order thinking, student-generated ideas, critical literacy, engagement), interpersonal (collaborative learning, teamwork, social connectedness), and intra-personal skills (self-directed learning, goal-setting, metacognition, self-regulation) across various subjects. Projects also range from primary to secondary levels. Particularly, this presentation will elaborate on the automated and semi-automated data collection, analysis and visualization techniques that are enacted in the LA projects and how these are used to formatively assess 21CC and foster student agentic and process-oriented learning.

The impact of the current use of LAs on student learning outcomes will be discussed, as well as, future directions for exploring the optimal potential of LA for fostering and assessing 21CC.

Abstract 3

Creating contexts for embedding 21CC in STEM: Pockets of excellence in Singapore schools

Dr. Sheryl Lyn MONTEROLA, University of the Philippines Diliman, Philippines

Developing future-ready learners that demonstrate both content mastery and creative-adaptive competencies for the 21st century has never been more imperative. Among the disciplines, the field of STEM exerts the greatest demand on learners for it requires a solid grasp of key concepts and high-level of thinking and problem-solving skills. Orienting the direction of STEM education towards future-readiness needs learning contexts that scaffold 21CC and enhance disciplinary mastery.

The term "pockets of excellence" refers to pedagogical innovations that improve both content mastery and 21CC student outcomes. This paper describes pockets of excellence in Singapore schools that embed 21CC in STEM. The discussion highlights diverse learning contexts that give rise to these pockets of excellence, e.g., student-generative learning, bridging formal-informal learning spaces, and deepening disciplinary literacy.

Enablers and inhibitors of 21CC in STEM will be discussed, as well as, implications of pockets of excellence in STEM on research, policy, and practice.

Keyword: 21st Century Competencies, Curriculum & Pedagogical Innovation

Distributedness of School Leadership:

Chairperson - Hairon Salleh, National Institute Of Education, Singapore
Educational Policies and Practices

Integrative Summary

This symposium will present three paper presentations that focuses on teacher leadership motivated and drawn from a research study, and key reflections from two Doctor of Education students who are both teacher leaders in the Singapore education. The symposium aims to surface the growing importance of teacher leadership in the Singapore education setting, and reflect on key challenges and levers to sustain the Third Phase of leadership development.

Abstract 1

Teacher Leadership in Singapore: Potential and Challenges

Hairon Salleh, National Institute Of Education, Singapore

Teacher leadership in the Singapore education has grown in importance over the last decade, and its significance has recently been given a boost by the education minister. Furthermore, greater clarity has also been given to role of teacher leaders especially the formal roles such as Senior Teachers (STs), Lead Teachers (LTs), Master Teachers (MTTs) and Principle Master Teachers (PMTs). Essentially four main roles have been identified by the education ministry: (1) teaching and learning, (2) mentoring, (3) professional conversations, and (4) professional ethos. Besides these formal teacher leadership roles, there are also informal teacher leadership roles such as Subject Reps, Level Reps and Level Coordinators. The growing interest in teacher leaders, at least in the local context, however does not commensurate with the studies that seek to corroborate or validate its significance in terms of the specificities of its practice and impact. Narrowing this gap would thus be vital to further understand the teacher leadership concept or construct. For example, it would be of great interest to understand how teacher leaders work in harmony or synergy with other teacher leaders, middle leaders (e.g., department heads), and senior leaders (e.g., vice-principals and principals) bearing in mind that it is an offshoot of distributed leadership. It would also be of great interest to understand the scope of teacher leaders' direct and indirect impact on school improvement processes and outcomes. The study employed a longitudinal survey using both quantitative and qualitative data analyses comprising hierarchical linear modelling (HLM), multi-level path analyses, Rasch Wright Map Analysis, and focused group discussion (FGD) techniques. The study essentially sought to uncover what teacher leaders do in their roles and the effectiveness of their roles, and the challenges that they face when enacting their roles en route to impacting school improvement processes and outcomes.

Abstract 2

The Inner Conversations of Conflicts by a Teacher Leader

Hairon Salleh, National Institute Of Education, Singapore
Lim Soh Peng, Presbyterian High School, Singapore

Although the introduction of the Teaching Track was introduced in 2001, the notion of teacher leadership emanating from within this track took on much greater emphasis in the recent years. A teacher now can aspire to grow in the Teaching Track to progressively become Senior Teacher (ST), Lead Teacher (LT), Master Teachers (MTT) and Principle Master Teachers (PMT). The initial motivation in creating the Teaching Track, along with the progressive designations within the track, was to create career choice and progression as part of revamping or renewing the teaching profession. The Teaching Track was created along with two other tracks – Leadership and Specialist. While the Leadership Track would serve to grow teachers to take up leadership positions such as Subject Heads (HS), Heads of Department (HODs) and Year Heads (YHs), the Specialist Track to grow teachers to become educational specialists in areas such as the various curriculum teaching subjects. A beginning classroom teacher would therefore have the choice to aspire and growth in one of these three tracks. The creation of these three tracks has been seen to be generally positive insofar as teachers are given a choice to focus on pedagogy and grow as a teacher leader whilst still remaining in the school context instead of having to focus on administration in the Leadership Track. Notwithstanding that the Teaching Track has matured over the recent years in the hands

of the Academy of Singapore Teachers, the development of the Teaching Track is still not without challenges. This paper presentation seeks to highlight some of the current challenges that bear upon teachers leaders through the unravelling of the inner conversations of a Lead Teacher. These inner conversations cover three main themes comprising context, roles and the essence (or construct) of leadership itself.

Abstract 3

Middle Leader as Teacher Leader in Instruction: Linking Distributed and Instructional Leadership

Hairon Salleh, National Institute Of Education, Singapore
Janice Khoo Mee Yoong, Ministry of Education, Singapore

Distributed leadership has been recognized to have the potential to make positive improvements in teaching and learning. How well a school distribute leadership, especially in terms of instruction, would have a significant impact on how well teachers are supported in teaching en route to student learning. However, empirical studies corroborating the links between distributed leadership and instructional leadership impacting on teaching en route to student learning still has room for much further development. The tight connections between distributed leadership and instructional leadership have been so well suspected or opined that some observers have created a new leadership type called 'distributed instructional leadership'. While there might be suspicion or debates over the substantive essence of this concept, the idea that instructional leadership can or should be distributed in school setting is very compelling bearing in mind that school leaders are facing increasing demands for change in an increasingly complex and uncertain environment. In the Singapore context, the need to distribute instructional leadership is obvious. School leaders lead schools that are relatively large in terms of student numbers (about 1,500 students). They are also faced with the need to innovate the school curriculum in ways that promote holistic education but not comprising on academic rigor. In addition, they are faced with increasing scrutiny from members of the community especially parents. Although research studies have looked into how distributed leadership functions in Singapore schools and its relationship to instructional leadership (e.g., Hairon & Goh, 2015; Hairon, Goh & Gopinathan, 2015), there is still no research study investigating the intimate or inter-dependent relationship between distributed leadership and instructional leadership. This paper presentation seeks to present a research proposal using ethnographic case study of a middle leader to qualitatively investigate this relationship.

Keyword: Educational Policy/Reform, Leadership

Symposium- SYM041

The MINDS journey in supporting students with autism spectrum disorders: Reflections from teachers

Chairperson - Kenneth Poon, National Institute Of Education, Singapore
Special Needs Education

Integrative Summary

In this symposium, teachers involved in an ongoing project to support students with comorbid moderate-severe intellectual disabilities as well as autism spectrum disorders (ASD) will share their respective reflective journey over the past year in this application of multiple case studies. In each case study, each teacher will share the challenges they have experienced in their respective classrooms in supporting students with ASD, strategies that they have applied, as well as key learning points as a teacher. In addition, they would also be sharing on how journeying as a broader professional learning community provided them with the support in their professional practice. Moreover, the application of a pilot tool to guide the establishment of a classroom supporting students with ASD will be shared.

Abstract 1

Supporting students with autism spectrum disorders at MINDS Fernvale Gardens School

Guo Yan Yan, Fernvale Gardens School, Singapore

Students with autism spectrum disorders (ASD) often represent a challenge to teachers. Apart from the repetitive behaviors that these students exhibit, their social and communication difficulties also lead to difficulties among some students with ASD to access classrooms employing traditional pedagogical methods.

At MINDS Fernvale Gardens School, we have over the past year sought to apply key components of structured teaching for supporting students with autism spectrum disorders. One of the ways is by drawing natural boundaries for students to understand the expectations of each learning area in the classroom. Students are able to predict and focus on the types of tasks assigned to them. Students are meaningfully engaged and the level of on-task behaviour is increased.

Additionally, we also employed a pedagogy whereby we maximise student engagement through the grouping and rotation of students with ASD within learning centres. However, it takes time to apply these principles. In this presentation, we describe the process of how we supported our students with ASD as well as the challenges and solutions.

Abstract 2

Supporting students with autism spectrum disorders at MINDS Towner Gardens School

Wu Han Yiin, Towner Gardens School, Singapore
Shen Sihui, Towner Gardens School, Singapore

Students with autism spectrum disorders (ASD) often have communication challenges resulting in difficulties not only in terms of their learning but also in their behavior. Although students with ASD are able to repeat lines they had previously heard, make vocal sounds or gesture with their hands, they are

generally not adept at communicating their needs, wants, likes and dislikes.

At MINDS Towner Gardens School, we have adopted a functional approach to teaching communication skills to our students by using visual methods of communication, creating opportunities for communication within their daily routines and teaching them to request, protest and seek help.

In this presentation, we will share the strategies that we have employed with students with different communication skills. This empowerment of students (both verbal and non-verbal) with the ability to communicate resulted in a higher level participation in the classroom. Issues in teaching communication to students with ASD will also be discussed.

Abstract 3

Supporting students with autism spectrum disorders at MINDS Woodlands Gardens School

Santha, Woodlands Gardens School, Singapore

According to DSM-V “persistent deficits in social communication and social interaction, Restricted, repetitive patterns of behavior, interests, or activities” are the key diagnostic features of Autism spectrum disorder (ASD). Perhaps resulting from that, difficulties in staying seated, the failure to attend to relevant stimuli and other behaviors may interfere their level of participation in the classroom activities. Strategies like behavior management, environmental modifications, sensory integration approach and functional communication are widely used to engage the students with ASD in the classroom.

Vogel (2008) has identified eight design standards; environment should be flexible and adaptable, non-threatening, non-distracting, predictable, controllable, sensory-motor attuned, safe and non-Institutional.

As physical setup of the classroom plays an important role in enhancing the level of participation of students with ASD, Woodlands Gardens School (WGS) has set up a classroom to accommodate the needs of students with ASD. In this presentation, the process by which the classroom was established to accommodate students with different needs meaningfully will be described. This classroom has space for specific activities such as independent work, group work and group teaching areas. There are special corners for reading, rest, sensory and computer activities. It is easily transformable based on individual needs of the students and the activities. Visual cues and functional communication strategies are implemented to help them to express their needs and wants, make choices and understand their routine. The furniture in the reading corner and rest corner are selected in order to provide a non-institutional feeling for the students. Over the period of time, students have been observed to participate actively in the classroom activities, request their needs and wants and exhibit less behaviors of concern. Classroom environment enhances functional communication of the students and empowered the teachers to engage students efficiently. Additionally, challenges as well as strategies to overcome them will be discussed.

Abstract 4

Supporting students with autism spectrum disorders at MINDS Lee Kong Chian Gardens School

Suraya, Lee Kong Chian Gardens School, Singapore
Choo Wee Kian, Lee Kong Chian Gardens School, Singapore

Supporting students with autism spectrum disorders (ASD) requires teachers with training. Research also indicates that teachers of students with ASD experience greater levels of stress. It thus implies teachers

of students with ASD need support.

In this presentation, the school-wide approach of supporting students with ASD employed at MINDS Lee Kong Chian Gardens School will be shared. Strategies for supporting students with ASD within individual classrooms, as well as the level-wide approach for the support of students with ASD will be shared alongside challenges experienced.

Keyword: Professional Development, Special Education