OER-CRPP INNOVATIONS FOR PEDAGOGICAL CHANGE: 5 Lessons
ABOUT OER

Research Empowers

The Office of Education Research (OER) at the National Institute of Education (NIE), Singapore brings together researchers, educators and administrators to provide evidence-based and research-informed improvements to teaching and learning.

OER was established on 1 April 2008 to forge an NIE-wide programme of education research, development and innovation. It administers research funding, such as the Education Research Funding Programme, a pool of research funds provided by the Ministry of Education (MOE), Singapore. It also supports education research on topics of interest to NIE and of importance to MOE and the broader education fraternity.

To find out more about OER, visit: http://www.nie.edu.sg/office-of-education-research

ABOUT CRPP

Sustaining Student and Teacher Learning

The Centre for Research in Pedagogy and Practice (CRPP) is a research centre of the Office of Education Research in NIE. Established in 2003, CRPP focuses on improving and sustaining student and teacher learning in Singapore schools through high quality research and development programmes that are innovative, relevant and responsive locally and internationally. It also designs and implements pedagogical innovations in formal and informal contexts, and generate rigorous and impactful school-based and system-level educational research that is cognisant of the sociocultural context of Singapore’s educational landscape.

Through collaborative partnerships with MOE, schools, families, communities, as well as other organisations within Singapore and internationally, CRPP’s aim is to bring about productive change in teaching and learning, and nurture the next generation of education researchers to enhance NIE’s research capacities.

To find out more about CRPP, visit: http://www.nie.edu.sg/research/research-offices/office-of-education-research/centre-for-research-in-pedagogy-and-practice-crpp
EXECUTIVE SUMMARY

This report documents the ongoing consolidation of OER and CRPP’s research in the 3rd tranche of Education Research Funding Programme (ERFP), specifically the kinds of innovations for pedagogical change and 5 key lessons we have learned about improving our education system.

A key and consistent theme of our research has always been on how to implement pedagogical innovations in our schools and classrooms.

The research emphasis has shifted since from what our system is like, to how to improve our system, in line with major reform initiatives since Thinking Schools, Learning Nation and Teach Less, Learn More.

It also discusses the leverages and mechanisms for educational change, of which the teacher’s role is critical, yet it provides lessons from a system’s perspective.

Documented from a school and system improvement perspective, this paper grounds change from an embodied and participatory learning epistemology and points efforts of reform towards life-long, life-wide, life-deep, and life-wise goals.

Purposeful Learning

The notion of purposeful learning is a useful and powerful frame to think about future-readiness. Given the VUCA (Volatile, Uncertain, Complex and Ambiguous) world we live in, the fluidity of our future and the uncertain complexities it carries, what becomes increasingly important for students and the system is to understand, fundamentally, why we should learn what we need currently and for the future. Here, the repeated focus on “why” is paramount: not just “why” for change, but “why” for learning.

1. Purposeful learning helps educators and learners to focus on the why behind learning goals and ensures that students understand how things that happen in learning, in class, in terms of activities, experiences, and assignments relate to those goals. This resonates strongly with the Thinking Schools, Learning Nation and Teach Less, Learn More initiatives which attempt to shift education towards student-centred learning, and through it, greater ownership of learning by students.

2. Purposeful learning is aligned to the Singapore Teaching Practice (STP). STP enables teachers to be professionals who enhance not only the “how” and “what” (content and pedagogical content knowledge), but crucially, their mastery of “why” in their use of learner-centred pedagogies. It is about teachers having a deep and purposeful engagement with content knowledge.

Purposeful learning is therefore about connecting learning to purpose, and by doing so, deliberately shifts the emphasis of learning away from the purpose of examination preparation or performance, to learning for passion and interest.

Doing so fundamentally refocuses education for life-long learning, where learning of knowledge, skills, values and dispositions is seen across time; life-wide learning or learning across different contexts and milieu; life-deep learning or deep expertise, which is about deepening the Instructional Core, and embedding intentional learning into the curriculum and curricular learning outcomes; and life-wise learning, where learning is not just for the self, which may result in a society of highly self-centred individuals.

Rather, it is about learning beyond the self, lending to the notion of wisdom and discernment, which is the act of being able to perceive different meanings, distinguish right from wrong, to connect individual and society, to withhold self-gratification for the greater good, and to exercise a form of practical wisdom.
Four-Life Learning Model

The future-ready learner’s agenda needs to focus on the meaning of purposeful learning as encapsulated in Life-long, Life-deep, Life-wide and Life-wise Learning (“Four-Life Learning”).

<table>
<thead>
<tr>
<th>LIFE-WIDE (LW)</th>
<th>LIFE-DEEP (LD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-world Connected Learning</td>
<td>Intentional &amp; Experiential Learning</td>
</tr>
<tr>
<td>Adaptability &amp; Transferability Across Contexts</td>
<td>Deep Subject Content Knowledge (EL-MA/SC/HUM)</td>
</tr>
<tr>
<td>Interdisciplinary Understandings (EL-MA/SC/HUM)</td>
<td>Efficiency &amp; Innovation</td>
</tr>
<tr>
<td>Multiple Perspectives</td>
<td>Adaptive Expertise</td>
</tr>
</tbody>
</table>

SOCIAL EMOTIONAL REGULATION & WELL-BEING

<table>
<thead>
<tr>
<th>LIFE-LONG (LL)</th>
<th>LIFE-WISE (LW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting Learning to Purpose</td>
<td>Learning beyond Self</td>
</tr>
<tr>
<td>Knowledge &amp; Dispositions Over Time</td>
<td>Values, Morals &amp; Character</td>
</tr>
<tr>
<td>Process &amp; Design Skill Retention</td>
<td>Practical Wisdom</td>
</tr>
<tr>
<td>Metacognition</td>
<td>Historical Empathy</td>
</tr>
</tbody>
</table>

- **Life-long Learning** is about the learning that occurs across one’s lifespan, from infancy to adulthood. It is about what is retained, why such knowledge, skills and dispositions are usefully kept, and the metacognitive processes that enable this.

- **Life-deep Learning** is about deep understanding of disciplinary content and also about adaptive expertise, which is about achieving both efficiency and innovation. Adaptive expertise is a key future-ready competency that learners must have to be able to balance between efficiency in doing tasks fluently and innovativeness in doing tasks creatively.

- **Life-wise Learning** is something we feel is deeply important to our future society, one which focuses the learners not only on values, morals, character, but on historical empathy.

- **Life-wide Learning** is about learning in multiple contexts. Learning occurs not just within the boundaries of the school, but outside of school, in informal learning environments.

    Research into formal and informal learning have shown that people spend the majority of their time from infancy to adulthood in informal learning settings, with about 20-30% time spent only in formal settings.

    Here, what is important is for learners to be increasingly adaptable and able to transfer their knowledge, skills, values and dispositions across contexts, have multiple perspectives, and strong interdisciplinary understandings.

It should be noted that we have projects that engage in aspects of these Four-Life Learning. For example, there are quite a number of projects in Curriculum & Instruction that focus on life-deep learning, which focuses on developing deep content mastery.
Purposeful learning as suggested here is aligned to the key educational ideas of the joy of learning, entrepreneurial dare and social cohesion. Taken together, these ideas are about preparing for a future-ready life through purposeful learning and not just for performance:

1. The joy of learning is about life-long learning dispositions, life-deep learning expertise and life-wide interests
2. Entrepreneurial dare is about life-deep expertise and mastery, and life-wide boundary crossing between contexts and disciplines, effectively thinking outside of the box
3. Social cohesion is about life-wise virtues, life-long character dispositions and life-wide cultural appreciation

Recently, more projects are moving towards life-wide learning, especially from the Learning Sciences Lab, a research centre at OER.

There are some nascent longitudinal studies and we also had the Panel Core 1-6 life pathways study, as well as studies on character development. Using this framework allows us to understand the gaps in our research work very quickly.

Quintessentially, learners are at the heart of learning. Preparation for future-ready learners requires both a balance of performative and inquiry pedagogies, with both academic and non-academic outcomes as an interplay and not in silos.

Educational outcomes that aim for mastery of both content and 21st century competencies (as commonly espoused in Singapore’s policy documents) are synergistic and dynamically linked. Teachers hold the authority of the classroom, and hence changing their beliefs (epistemic shifts) are at the heart of system change. Both school and system leaders are movers and shakers of their schools and system respectively, and they hold the key to spreading and sustaining innovative learning and instructional practices.

Five Lessons from Ongoing Research Consolidation Efforts – Deepening the Connections for Purposeful Learning

LESSON 1
DEEPENING CONNECTIONS BETWEEN THE HEAD AND THE HEART

From responsibility for preparing mainly for exams to preparing for purposeful learning.

Teachers are used to receiving programmes from schools and MOE, but here we want to shift from such programmes and exam-driven learning designs to purposeful learning designs.

LESSON 2
DEEPENING CONNECTIONS BETWEEN THEORY AND PRACTICE

From exam preparation to taking ownership of their own purposeful learning.

LESSON 3
DEEPENING CONNECTIONS BETWEEN THE HARDWARE AND SOFTWARE IN SUPPORT OF HEARTWARE

From learning and informal learning seen in silos to an integration of formal and informal learning for purposeful learning.

LESSON 4
DEEPENING CONNECTIONS BETWEEN LEARNERS’ PERFORMANCE WITH PURPOSE

Shifting from directing or implementing educational innovations to catalysing sustainable and pervasive innovations that can lead to purposeful learning.

LESSON 5
DEEPENING CONNECTIONS BETWEEN THE IN- & OUT-OF CLASSROOM LEARNING
OER-CRPP INNOVATIONS FOR PEDAGOGICAL CHANGE: 5 LESSONS

Preamble

This paper documents the ongoing consolidation of OER’s and CRPP’s research in the 3rd tranche of ERFP funding, specifically the kinds of innovations for pedagogical change and 5 key lessons we have learned about improving our education system. A key and consistent theme of our research has always been on how to implement pedagogical innovations in our schools and classrooms.

This theme began in the 1st ERFP’s focus on systems-level baseline studies which describes what pedagogy is like in our schools, and made recommendations to improve them through a series of interventions in key domain areas such as English, Math, Science, and ICT in the 2nd ERFP, and subsequently scaling and translating such interventions across schools in the 3rd ERFP.

The research emphasis has shifted from what our system is like, to how to improve our system, in line with major reform initiatives since Thinking Schools, Learning Nation and Teach Less, Learn More.

This paper discusses the leverages and mechanisms for educational change, of which the teacher’s role is critical, yet it provides lessons from a system’s perspective.

Documented from a school and system improvement perspective, this paper grounds change from an embodied and participatory learning epistemology and points efforts of reform towards life-long, life-wide, life-deep, and life-wise goals.

NIE Research Development Strategies

<table>
<thead>
<tr>
<th>Year</th>
<th>ERFP Funding</th>
<th>Strategy on Research Focus</th>
<th>Organisational Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 - 2007</td>
<td>1st ERFP (S$48m)</td>
<td>Baseline Studies</td>
<td>Establish Research Wing</td>
</tr>
<tr>
<td>2008 - 2012</td>
<td>2nd ERFP (S$96.6m)</td>
<td>Intervention Studies</td>
<td>Foster NIE-Wide Participation</td>
</tr>
<tr>
<td>2013 - 2017</td>
<td>3rd ERFP (S$111.58m)</td>
<td>Scaling &amp; Translation</td>
<td>Develop Multiple Perks of Excellence</td>
</tr>
<tr>
<td>2018 - 2022</td>
<td>4th ERFP</td>
<td>“Research-Informed Education for Future-ready Learners”</td>
<td>Develop &amp; Grow Hubs of Excellence in Key Areas such as Early Childhood</td>
</tr>
</tbody>
</table>

Image 2. Growing Research Impact.
NIE’s research strategy has evolved organisationally from establishing research capacities within research centres to NIE-wide research capacity building in the 2nd ERFP as shown in image 2.

The opening up of research has led to an active research culture generating strategic research strengths over the years. This has allowed the research trajectory to develop into hubs of excellence in key areas such as early childhood research.

The establishment of the Centre for Research in Child Development (CRCD) in April 2017 and the National Institute of Early Childhood Development (NIEC) are signs of the level of research maturity that NIE has achieved in strategic areas since 2002.

The research trajectory since 2003 has also seen increase in the number of research projects that involve MOE officers as co-researchers, with school participation in NIE research increasing with an average of 3 to 4 schools per OER project.

At the same time, collaboration with various professional bodies such as the Academy of Singapore Teachers, and English Language Institute of Singapore, have increased over the years.

The agenda for the 4th ERFP is focused on “Research-Informed Education for Future-Ready Learners”. This builds on NIE’s unique strengths of transformation, wisdom, partnership, purpose, and coherence.

---

**TRANSFORMATION**

The sustained development of research capacities of NIE staff with many producing high quality research on Singapore classrooms.

---

**WISDOM**

Researchers who hold deep knowledge of Singapore’s education and have a strong commitment to making a positive impact on Singapore’s education system.

---

**COHERENCE**

Direct access to teacher education programmes have facilitated connecting the research-practice nexus.

---

**PARTNERSHIP**

The close partnerships with MOE and schools have created a space for researchers to be catalysts for research-driven improvement.

---

**PURPOSE**

The Singapore Teaching Practice has created a purposeful space that links all levels of our education system, from schools to NIE to the ministry, together to talk about what really matters – teaching to help students learn well, and meaningfully.
**Strengths & Emerging Key Research Programmes**

Over the recent tranches, NIE researchers have engaged in research in key areas as seen in the diagram as shown in image 3 below.

Importantly, while the quantum may vary across these research areas, what has emerged are two trends.

First, our research strength and emphasis continues to be on the Instructional Core – teachers teaching and interacting with students win the presence of curricular content.

Second, the focus on the Instructional Core is supported by research that investigates the ways in which the Instructional Core can be enhanced, through learning sciences and technology, leadership, and means to diffuse and share innovative teaching and learning practices.

The research outcomes largely emphasises disciplinary mastery as well as 21st century learner competencies.

---

**Impact: Strengths & Emerging Key Research Programmes**

21st Century Competencies & Student Outcomes

---

**Methodology for Research Consolidation**

The surfacing of such research strengths is only possible because of recent OER-level strategic implementations of knowledge management (KM) and mobilisation processes that enable us to data-mine our projects and develop a rich database to understand NIE’s research development.

As a result of the KM efforts, OER has formed consolidation teams (“Metasynthesis Task Forces”) around each of these key research niche areas:

- Curriculum, Assessment and Pedagogical Innovations
- Teacher Learning and Professional Development
- Creativity and 21st Century Competencies
- Low Progress Learners
- Scaling & Diffusion
- Leadership

These teams held continuous dialogues between OER management and various stakeholders to ensure that the consolidation process is rigorous and yields high utility value.

The first consolidation was a synthetic review that summarises the research efforts in a niche area without any explicit foci. This was documented in the 4th Tranche Proposal’s Annexes A to F for the 6 niche areas, with Annex G as a secondary consolidation of these Annexes.

While very much a work in progress, our further dialogues and consolidation efforts have surfaced 5 key lessons focusing on understanding how to enable pedagogical change. This change has to have a focus – an end point or objective – and we propose two focal points for change:

- a continued focus on improving the Instructional Core
- a focus on purposeful learning which is key to our future-ready learners’ agenda.
Purposeful Learning

The notion of purposeful learning is a useful and powerful frame to think about future-readiness. Given the VUCA (Volatile, Uncertain, Complex and Ambiguous) world we live in, the fluidity of our future and the uncertain complexities it carries, what becomes increasingly important for students and the system is to understand, fundamentally, why we should learn what we need currently and for the future. Here, the repeated focus on “why” is paramount: not just “why” for change, but “why” for learning.

Purposeful learning helps educators and learners to focus on the why behind learning goals and ensures that students understand how things that happen in learning, in class, in terms of activities, experiences, and assignments relate to those goals. There is an increasing recognition that a purpose-driven life is important in the face of uncertainty, that a steadfast direction is needed.

This resonates strongly with the Thinking Schools, Learning Nation and Teach Less, Learn More initiatives which attempt to shift education towards student-centred learning, and through it greater ownership of learning by students, as well as making meaningful and purposeful connections between what students learn today and how such knowledge, skills, values and dispositions will be useful and critical for the future.

Purposeful learning is aligned to the Singapore Teaching Practice (STP) as it enables teachers to be professionals who enhance not only the “how” and “what” (content and pedagogical content knowledge), but crucially, their mastery of “why” in their use of learner-centred pedagogies.

Therefore, purposeful learning is about connecting learning to purpose, and by doing so, deliberately shifts the emphasis of learning away from the purpose of examination preparation or performance, to learning for passion and interest.

Doing so fundamentally refocuses education for Life-long Learning, where learning of knowledge, skills, values and dispositions is seen across time. Purposeful learning also shifts the emphasis towards real-world connected learning, and therefore the notion of Life-wide Learning or learning across different contexts and milieu becomes important.

Purposeful learning is about deepening the Instructional Core, that there is both intentional learning as embedded in the curriculum and curricular learning outcomes, and also experiential learning that students gain throughout schooling. This leads to deep expertise or Life-deep Learning.

Finally, learning cannot be just for the self which may result in a society of highly self-centred individuals. Rather, it has to be about learning beyond the self, and this lends to the notion of wisdom. From Western and Eastern philosophers such as John Dewey and Confucius, wisdom is about self-control and mindful contemplation.

Confucius, wisdom is about self-control and mindful contemplation. It goes beyond knowledge of fact and truth, but a conviction of moral values, a sense for the better kind of life one can have or a desired future. Confucius famously stated that “love of learning is akin to wisdom”.

Wisdom, therefore, is about discernment, the act of being able to perceive different meanings, distinguish right from wrong, to connect individual and society, to withhold self-gratification for the greater good, and to exercise a form of practical wisdom, what Aristotle calls “phronesis”, or Life-wise Learning.
Four-Life Learning Model

The future-ready learner’s agenda needs to focus on the meaning of purposeful learning as encapsulated in Life-long, Life-deep, Life-wide and Life-wise Learning (“Four-Life Learning”).

These four forms are anchored by social emotional regulation and the well-being of the individual learner (both students and teachers).

1. **Life-long Learning** is about the learning that occurs across one’s lifespan, from infancy to adulthood. It is about what is retained, why such knowledge, skills and dispositions are usefully kept, and the metacognitive processes that enable this.

2. **Life-deep Learning** is about deep understanding of disciplinary content and also about adaptive expertise, which is about achieving both efficiency and innovation.

   John Bransford and colleagues have flagged adaptive expertise as a key future-ready competency that learners must have to be able to balance between efficiency in doing tasks fluently and innovativeness in doing tasks creatively.

3. **Life-wise Learning** is something we feel is deeply important to our future society, one which focuses the learners not only on values, morals, character, but on historical empathy which is something that Lee Kuan Yew himself is deeply concerned about – that citizens will forget the difficult history of nation building and take things for granted.

4. **Life-wide Learning** is about learning in multiple contexts. Learning occurs not just within the boundaries of the school, but outside of school, in informal learning environments. Research into formal and informal learning have shown that people spend the majority of their time from infancy to adulthood in informal learning settings, with about 20-30% time spent only in formal settings.

Here, what is important is for learners to be increasingly adaptable and able to transfer their knowledge, skills and dispositions across contexts, have multiple perspectives, and strong interdisciplinary understandings. Examples from world-leading innovators such as Steve Jobs and Nobel Laureates show that many of them see learning as boundary-less, transcending contexts and disciplines.
Purposeful learning as suggested here is aligned to the key educational ideas of the joy of learning, entrepreneurial dare and social cohesion.

Taken together, these ideas are about preparing for a future-ready life through purposeful learning and not just for performance:

**Entrepreneurial dare is about life-deep expertise and mastery, and life-wide boundary crossing between contexts and disciplines, effectively thinking outside of the box.**

**The joy of learning is about life-long learning dispositions, life-deep learning expertise, and life-wide interests.**

**Social cohesion is about life-wise virtues, life-long character dispositions and life-wide cultural appreciation.**

---

**Embodied-Participatory Learning Epistemology**

Much of school and workforce learning is taught through sit-in-classroom type courses. The learning sciences, which were introduced more than a decade ago, sought for alternative conceptions of learning which were non-objectivistic and questioned the epistemological assumptions of knowledge.

This new paradigm marked an epoch of new research developments in the fields of cognitive psychology and neuroscience which resulted in greater understanding of the science of learning with implications for practical application.

However, the majority of schools remains as institutions with socio-technical structures that afforded canonical solutions of the former paradigm. If schools are hard to undergo reform, it is unlikely that an entire system can change.

Image 5 on page 16 is derived from the observations drawn from OER’s combined intervention research projects conducted in local Singaporean schools.

Additionally, the learning framework below explains how epistemic beliefs are appropriated or enculturated, and that actions, behaviors and cognition are needed in a holistic interplay within a social-phenomena context.

It involves both an embodied (see the phenomena and selves dialectics) and participatory (see the reifications and selves dialectics) interactions in learning.

Explanations can be made not just in textual and multimodal forms;
research in OER also imbues gestural actions as explanation mechanisms. Quintessentially, learners are at the heart of learning.

Preparation for future-ready learners requires both a balance of performative and inquiry pedagogies, with both academic and non-academic outcomes as an interplay and not in silos.

Educational outcomes that aim for mastery of both content and 21st century competencies (as commonly espoused in Singapore’s policy documents) are synergistic and dynamically linked.

Teachers hold the authority of the classroom, and hence changing their beliefs (epistemic shifts) are at the heart of system change.

Both school and system leaders are movers and shakers of their schools and system respectively, and they hold the key to spreading and sustaining innovative learning and instructional practices.

**Five Lessons Characterised by Embodied-Participatory Designs for Purposeful Learning**

Teachers are already engaged in some form of purposeful learning to varying degrees, for example through Co-Curricular Activities (CCAs) and Applied Learning Programmes (ALPs).

What we want to do is to deepen those connections that they and schools are doing. This requires teachers to undergo an epistemic change in their beliefs about teaching and learning.

Such a change can be achieved through apprenticeship, ownership of curriculum design, professional development and situated learning, interventions, understanding formal/informal learning, and developing strong assessment literacies.

These are supported by Professional Learning Communities (PLCs) and Networked Learning Communities (NLCs) leading to purposeful learning outcomes.
Detailed below are the 5 key lessons we have surfaced from our ongoing consolidation efforts. These 5 lessons all center around deepening the connections for purposeful learning.

**LESSON 1**
**DEEPENING CONNECTIONS BETWEEN THE HEAD AND THE HEART**

Our research strongly suggests that shifting teachers’ beliefs is the highest leverage point for preparing learners for future-readiness. Our innovation research has shown how changes in teachers’ epistemic beliefs can occur by getting to their hearts - their passion for helping their own students - to prepare for life and the future economy.

**LESSON 2**
**DEEPENING CONNECTIONS BETWEEN THEORY AND PRACTICE**

The lesson is on learning designs and shifting them from a narrow focus on summative or high stakes assessments to purposeful learning. This requires the need to strengthen teacher competencies in innovative task design and formative assessments, both seen to be key areas of improvement based on our baseline studies.

**LESSON 3**
**DEEPENING CONNECTIONS BETWEEN THE HARDWARE AND SOFTWARE IN SUPPORT OF HEARTWARE**

The third lesson seeks to make innovations in schools sustainable and pervasive. For good innovations to spread far and long, school leaders are the key catalysts to do this, and supportive leadership create the positive conditions and cultures for teachers to experiment and innovate with changes to their practice.

**LESSON 4**
**DEEPENING CONNECTIONS BETWEEN LEARNERS’ PERFORMANCE WITH PURPOSE**

The fourth lesson is about deepening student ownership for their own learning. Our research shows that student agency can be encouraged through in/out of class learning, through forms of peer learning including student-involved assessments such as self and peer assessments, through developing competencies for peer interactions such as teamwork, and key competencies for the future such as resilience.

**LESSON 5**
**DEEPENING CONNECTIONS BETWEEN THE IN- & OUT-OF CLASSROOM LEARNING**

The fifth lesson focuses on integrating the learning that occurs inside and outside of classrooms. Students learn everywhere, not just in schools. Their learning identities are therefore constructed across boundaries, and our studies have shown that through student narratives, they learn to make sense of their identities and construct them especially around interest-based pursuits and for their own purposes, which is important.
Our research strongly suggests that shifting teachers’ beliefs is the highest leverage point for preparing learners for future-readiness.

Our innovation research has shown how changes in teachers’ epistemic beliefs can occur, by getting to their hearts - their passion for helping their own students - to prepare for life and the future economy.

This can be done through forms of apprenticeship, which is effective because it is participatory and embodied – not only do they see how things can work, they work to make it work.

Through doing so, teachers undergo “seeing is believing” – when they see their students learning and thinking visibly, using innovative practices such as inquiry-based approaches, they begin to find utility in such pedagogies and will incorporate it into their existing system of practices.

This is even more poignant in the case of low-progress students where teacher epistemic changes can enhance the pedagogical supports provided to students, including providing appropriately challenging tasks to improve learning. Teachers are not only the epistemic authority in the classroom, they are also the pivotal agents of change in the system.

Put simply, if teachers are resistant to changing their instructional practices in classrooms, the entire system will not be able to move forward from an examination focused emphasis to a purposeful learning one.

While teachers have many constraints, change for the larger purpose is needed. Getting to teachers’ heart is key.

Teachers need to embody their role and identities as professionals, while acknowledging that they are life-long, deep, wide, wise learners of their own rights.

As active learners themselves, teachers have a role to play in enabling an active learning culture in schools, through sharing, interacting, collaborating and being critical friends of their peers’ practices through PLCs, NLCs, and school-to-school networks.

Teachers develop a design capacity, apprenticed by experienced teachers with inquiry-based learning competencies, to understand how learning and teaching can be actualized.

Moreover, teachers need a strong curriculum framework with much meaning making to make sense of the curriculum to inform their practices.

Taken together, these enablers have been shown to change teacher beliefs, which in turn also lead to an increase in pedagogical repertoires for teachers.

LESSON 2
DEEPENING CONNECTIONS BETWEEN THEORY AND PRACTICE

The second lesson is about learning designs and shifting them from a narrow focus on summative or high stakes assessments to purposeful learning.

This requires the need to strengthen teacher competencies in innovative task design and formative assessments, both seen to be key areas of improvement based on our baseline studies.

To do so, designs need to help develop students’ abilities to see the big picture, a form of metacognition, and to develop content that encourages authentic inquiries driven by evidence and examples.

This is possible even with low-progress students. Teacher champions help spread innovations with the support of school socio-technical infrastructures to enable teachers to experiment with innovations on task design and formative assessments in a safe space.

Fundamentally, teachers see tasks as a sequence of instructional activities but our research has continued to educate teachers that tasks are much more than that, that they need to understand tasks carry the fundamental learning work through which students acknowledge knowledge, skills and dispositions.
International research continues to emphasise the importance of teacher-initiated and school-initiated well-designed tasks and our research continues to embrace this.

Arising from our analysis of the task designs from OER’s interventions, image 6 above depicts the key strategies adopted.

Tasks are designed with significant pedagogical content knowledge by teachers and researchers with intentional gaps in the tasks. These tasks are also designed with a clear understanding of students’ prior knowledge and hence “beyond their ZPD” (or zone of proximal development).

Consistent across OER’s interventions is the appropriation of disciplinary genres as scaffolds for student-to-student and teacher-student discourses in the classrooms. The use of disciplinary oriented meta-languaging is a strong indicator for change in instructional practices.

The third lesson seeks to make innovations in schools sustainable and pervasive.

For good innovations to spread far and long, school leaders are the key catalysts to do this, and supportive leadership create the positive conditions and cultures for teachers to experiment and innovate with changes to their practice.

A range of school support structures can facilitate this catalysis, along with “metalanguaging” – a common shared language between teachers and school leaders to understand innovations.

Ecological leadership is also key to enabling the sustainability and spread of good innovations, and evidence of this is seen in a number of primary and secondary schools, including SJI, the Future Schools, SOTA, Bendemeer Primary School.

OER’s research recognises that schools are necessarily ecological in nature. That is, schools are sites where relationships between...
individual actors (teachers, students, parents, leaders, and other stakeholders) and their social environments are acted out, and trust fostered.

School and teacher leaders are therefore not just people who lead from the top, but more importantly, they “lead from the middle” in a distributed manner.

Middle leadership is emphasised as there is a need to capitalise on proximal connections and enable psychological ownership across the layers of the school and the system (micro, meso, macro layers in image 7).

Such ecological leadership enables and sustains teacher change through vertical percolations up and down layers. Through ecological leadership, teachers, teacher-leaders and school leaders can champion curricular innovations and foster coherence upwards and downwards.

LESSON 4
DEEPENING CONNECTIONS BETWEEN LEARNERS’ PERFORMANCE WITH PURPOSE

The fourth lesson is about deepening student ownership for their own learning.

Our research shows that student agency can be encouraged through in/out of class learning, through forms of peer learning including student-involved assessments such as self and peer assessments, through developing competencies for peer interactions such as teamwork, and key competencies for the future such as resilience.

Purposeful learning can be owned by students when they develop deep content mastery through engaging and interest-based learning. A range of projects have seen these are possible, including the seamless learning project, MIVIS, studies into fieldwork and niche programs, WiREAD, Six Learnings etc.

Curriculum innovations that bridge between academic and 21CC learning have resulted in greater learner agency. Students were observed to generate inquiry responses such as questioning, argumentation, tinkering, etc.

Academically low-progress students also exhibited greater learner agency in both classroom and out of classroom learning situations. These learners exhibited ‘out of the box’ student generated contributions apart from text-book questions or answers.

Cumulatively, these studies in student-oriented inquiry research have seen changes in instructional practices and norms.

LESSON 5
DEEPENING CONNECTIONS BETWEEN THE IN- & OUT-OF CLASSROOM LEARNING

The fifth lesson focuses on integrating the learning that occurs inside and outside of classrooms.

In order to develop life-long, life-wide, life-deep and life-wise learning, schools and teachers are required to have the space, resources, time and knowledgeable others to help them conduct iterative improvement cycles of experimenting, testing, re-enacting, studying.

Research evidence shows students acquiring key knowledge, skills and dispositions in these environments but the issue of transferability remains a challenge that we continue to engage in. Examples are research into CCAs, makerspaces and ALPs.

The integrative interplays that can be afforded from the perspective of the learners can be significantly enhanced.

Such an interplay can also unpack the kinds of struggles, tensions, successes and failures of our learners and reveal important insights into how educative processes can be designed for productive cognitive, emotive, and dispositional habits of mind, with the resiliency and persistence needed to succeed in life.

Such trajectories are consistent to the life-long, life-wide, and life-deep learning espoused.
Across these 5 lessons we also argue that connections can be deepened vertically and horizontally. Vertical deepening focuses on conceptual depth and innovations that help to strengthen adaptive expertise.

The use of a common language -- metalinguage -- for teachers, students and leaders so that they all work towards innovations is fundamental.

This includes teacher-student interactions in classrooms around disciplinary genres, teacher-teacher interactions around design-language competencies, the use of metalinguage by school leaders and teachers in innovation cultures.

Making student thinking and learning visible, as John Hattie (2009) has pointed out, is important too, and once students are efficient, especially for procedural fluency, they need to refocus on innovativeness.

Here, learning analytics holds much promise for improving students’ abilities to gauge for themselves where their learning is at.

At the chalkface, Assessment for Learning protocols can be quickly utilised by teachers, such as think aloud, to surface misconception or alternative conceptions that can lead to erroneous conceptual understanding.

Finally, the harnessing of embodied performances by students – not just learning in the mind, but learning in the mind, body and hands, is key to new understandings about the science of learning. Horizontal deepening focuses on how to grow innovations strategically and rapidly.

This requires continuous dialogues and relationship building between PLCs and NLCs, especially when they shift their focus onto purposeful learning. There is also a need to be mindful of power distances between leaders, teachers and students, but there are ways to negotiate these – through distributed leadership and through communication.

Finally, cross connections can be made by emphasising big curricular ideas and encouraging students to think outside of their comfort zones in the subject domains, as well as having more opportunities for metacognition, something that baseline studies show are not pervasive enough.

The table below describes the key lessons to the purposeful learning framework.

| LIFE-LONG (LL) | LESSON 1 | HEAD TO HEART | Teacher metalinguage use according to disciplinary ways of seeing meanings |
| LIFE-DEEP (LD) | LESSON 2 | THEORY TO PRACTICE | Teacher track specialisations across BT, ST, LT, and beyond |
| LIFE-WIDE (LWd) | LESSON 3 | HARD/SOFT-WARE TO HEARTWARE | Teacher champions develop apprenticing and ecological leadership |
| LIFE-WISE (LWs) | LESSON 4 | TOWARDS STUDENT AGENCY | School leaders develop expertise in curriculum and instructional leadership |
| LIFE-WIDE (LWd) | LESSON 5 | TOWARDS FORMAL & INFORMAL LEARNING INTEGRATION | Student “voicedness” leads to process and product outcomes leading to greater motivation agency |

Teacher beliefs lead to sustained teacher learning and innovations’ explorations

Teachers deepen expertise for both performative and inquiry pedagogies

Teachers are open to handling different learners and their needs

Teachers are ready to handle diversity of student needs

Teachers deepen values with wisdom in handling diversity of student needs

Teachers deepen expertise for both performative and inquiry pedagogies

Teachers deepen expertise in mentoring

Teachers engage in PLCs and NLCs to deepen expertise

Teachers work on task designs that might span inter-disciplinary connections

Teachers work on student ideas and questions and facilitate wisely for equity and sensitivity of issues

School leaders develop deep expertise in innovation fostering and change management

School leaders learn about ecological leadership

School leaders develop expertise in mentoring

Students get exposed to other peers across “streams” and interests

Students have access to participation in a wide range of varied ViAs, CCAs and niche non-academic programmes

Students’ intra and inter-personal development in terms of values, empathy and wisdom through their participation in all academic and non-academic programmes including positive psychology and well-being programmes.

Students attempt to broker their own identities across contexts

Students pursue interests beyond school through some appropriate form of recognition such as bringing in their outside experience into the school to benefit other students

Students are engaged in school activities to benefit outside organisations that will help develop values, empathy and wisdom in them

Students deepen expertise (critical skills for life) through ViAs, CCAs, Niche programmes learning

School leaders learn how to capitalise on within school informal opportunities

Students get exposed to other teachers concerning a change in innovations agenda

Urgency can be used as a catalyst for change

Teacher champions develop deep expertise in mentoring

School leaders develop expertise in curriculum and instructional leadership

Students deepen expertise (critical skills for life) through ViAs, CCAs, Niche programmes learning

Students attempt to broker their own identities across contexts

Students pursue interests beyond school through some appropriate form of recognition such as bringing in their outside experience into the school to benefit other students

Students are engaged in school activities to benefit outside organisations that will help develop values, empathy and wisdom in them
The lessons we have gained from our consolidation have surfaced that change is a non-trivial, multi-layered, multi-faceted, multi-stakeholder process. As we move into the 4th tranche, the scope of educational research has to necessarily shift towards a clearer, deeper, engagement with these 5 key areas listed below that can help improve our understanding of change.

As we move into the 4th tranche, the scope of educational research has to necessarily shift towards a clearer, deeper, engagement with these 5 key areas listed below that can help improve our understanding of change.

We have pockets of research in some of these, and the 4th tranche’s design will allow for greater coherence and integration.

The figure below shows the key variables and key questions that can help us frame future innovation research.

### LEVELS OF CHANGE

- System
- Zone
- Cluster
- School
- Group
- Individual (Teachers & Students)

### WHERE ARE WE NOW?

- Culture
- Structure
- People
- Funding & Resourcing
- (Meta)
- Evolution

### HOW DO WE CLOSE THE GAP?

### WHAT ARE THE OUTCOMES?

### SCOPe OF EDUCATION RESEARCH

- Research & Implementation Frameworks
- Principles of Change & Diffusion
- Approaches & Conditions for Change & Diffusion
- Tools & Resources for Analysis
- Tools & Resources for Evaluation

### DIMENSIONS OF CHANGE

- Leadership for Sustainable Innovations
- Teachers’ Beliefs
- Teachers’ Learning Designs
- Students’ Purposeful Learning
- Formal-Informal Learning Integration

Image 8. Model of Change and Diffusion of Educational Innovations.
5 Priority Areas of Research for 4th Tranche

One of the main objectives of the 3rd tranche was to develop research peaks of excellence. Following the consolidation of the 3rd tranche research, the consideration of MOE’s existing and future needs and the research strengths of NIE, 5 priority areas of research have been identified which have the potential to create intersecting synergies between the Four-Life Learning aspects stated below.

The figure on the following page shows an overview of the consolidation process from the 6 Niche Areas to the 5 Key Lessons described above framed by Purposeful Learning and the Four-Life Learning, and how the 4th tranche’s 5 Priority Areas of Research (PARs) can continue to enhance Purposeful Learning and life-long, life-wide, life-deep and life-wise learning to prepare future-ready learners.
FUTURE-READY LEARNERS’ AGENDA

Consolidation: 5 Lessons

L1: Teacher Change

L2: Curriculum & Assessment Designs

L3: Leadership

L4: Student Agency

L5: Formal / Informal Learning

5 Priority Areas of Research (4ERFP)

Cognitive, Emotional and Social Development

Teacher Learning & PD

Schools, Leadership & System Studies

Learning Sciences & Technology

21CC & Motivation

Innovations for Pedagogical Change

Purposeful Learning

Life-long Learning

Life-deep Learning

Life-wide Learning

Life-wise Learning

Importantly, the 5 Priority Areas of Research (PARs) are not devoid of the traditional subject-domains. Rather, the PARs intersect with key Strategic Cross-cutting Foci Areas such as Math, Science, Early Childhood, Bilingualism, Literacy, Low-Progress Learners, and the Singapore Teaching Practice (STP). These cross-cutting areas will be areas of research across all the five PARs.

Image 10. Research Synergies Across the 5 Priority Areas.
### Potential Programmes of Research in the 4th Tranche’s 5 Priority Areas of Research

To help understand how the 5 PARs can attend to the future-ready learners’ agenda of purposeful learning, the table below draws up a matrix of the 5 priority areas against the 4 forms of learning—life-long, life-deep, life-wide, and life-wise. Each cell contains examples of learning that can be conducted in these areas. Across the 4 forms of learning are the key themes for each—“Lifespan and Passion”, “Expertise and Application”, “Transfer and Boundary Crossing”, “Discernment and Belief”. These themes describe the underlying research foci for the Four-Life Learnings, and how the 5 PARs can help to engage in research around these.

For example, the Cognitive, Emotional and Social Development PAR can engage in all 4 forms of learning through studying learner profiles over time, from child to adulthood, engage in studying learning mechanisms that enable expertise from cognitive, social and emotional perspectives, investigate transferable cognitive mechanisms, and seek to understand what wisdom means for students, and how this can be taught.

Therefore, each PAR has the potential to work towards fundamental understandings of life-long learning, life-deep learning, life-wide learning and life-wise learning. More importantly, they can inform each other interactively and cohesively because while they have a clear focus, especially in terms of units of analysis (learner, teacher, school), they also cross-cut in terms of their research agenda.

All the 5 PARs are purposefully directed towards creating the future-ready learner, teacher and school, and towards engaging in the key fundamental forms of learning that will be important in the future.

<table>
<thead>
<tr>
<th></th>
<th>CESD</th>
<th>LS&amp;T</th>
<th>21CC&amp;M</th>
<th>TLPD</th>
<th>SLSS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LIFESPAN &amp; PASSION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIFE-LONG (LL)</td>
<td>Describing learner profiles and characteristics over the schooling and IHL life span (K-12 &amp; to 25yo)</td>
<td>Implementing learning interventions at critical transitional stages throughout schooling life span</td>
<td>Developing adaptability &amp; transitional transfer mechanisms over schooling life span</td>
<td>Sustaining learning passions (joy of learning)</td>
<td>Developing sustained and deep teachers’ and experts’ learning for intrinsic purposes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EXPERTISE &amp; APPLICATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIFE-DEEP (LD)</td>
<td>Investigating learning mechanisms for adaptive expertise</td>
<td>Investigating meta-langauging and gestural embodiment effects</td>
<td>Developing adaptive expertise and student agency</td>
<td>Developing intrinsic student motivation for deep learning</td>
<td>Developing teachers as designers of learning and environments (TPCK, collaborative learning, etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TRANSFER &amp; BOUNDARY CROSSING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIFE-WIDE (LWd)</td>
<td>Investigating transferable cognitive, adaptive, and other social mechanisms</td>
<td>Implementing tasks and assessments that encourage multiple perspectives and experiences</td>
<td>Developing tasks and assessments that encourage ideational connections of big ideas across curriculum</td>
<td>Developing 21C competency transfer and application across multiple contexts</td>
<td>Developing teacher capacities for cross-context/discipline task and assessment designs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DISCERNMENT &amp; BELIEF</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LIFE-WISE (LWs)</td>
<td>Investigating emotions, wisdom, and regulatory mechanisms</td>
<td>Investigating self-regulation/transfer of resilience between informal and formal learning contexts</td>
<td>Building character and historical empathy via formal and informal learning opportunities</td>
<td>Investigating teacher experience and teacher practical wisdom, pedagogical agility</td>
<td>Investigating leader practical wisdom and enablers to broker and facilitate purposeful learning</td>
</tr>
</tbody>
</table>
REFERENCES


ACKNOWLEDGEMENTS

Special thanks goes to the research consolidation team from the Office of Education Research at the National Institute of Education, Singapore for their hard work in preparing this report. They include the following:

- Professor David Hung
- Associate Professor Koh Thiam Seng
- Dr Dennis Kwek
- Dr Jennifer Tan

Cite this report: