

## TEACHER ED

### Growing a 21st century teaching force

*“21st century learners call for 21st century teachers.” How many times have we heard this dictum repeated in the last decade? And yet, as much as we may wish to ignore it, we cannot deny the truth of the statement. What can be done to better equip teachers for schooling in the 21st century?*

#### Article highlights

- Why do we need to rethink the current teacher education programme?
- What values, skills and competencies do 21st century teachers need?
- What changes can Singapore teachers expect in terms of professional development?

*“The top 10 in-demand jobs projected for 2010 did not exist in 2004. In today’s world, individual and societal success increasingly depends on our capacity to learn. And societies rely, as never before, on our capacity to teach.”* – Professor Linda Darling-Hammond, Stanford University (cited in Davie, 2009)

The role of the teacher is more important now than ever before. In the words of Prof Darling-Hammond:

Teachers’ work, while always complicated, is becoming ever more important as the challenges for which they prepare their students are becoming more complex. (in Low, Taylor, Joseph, & Atienza, 2009, Foreword)

Our youth must be well-equipped to survive and succeed in the new global landscape. Not only do they need to have the mind but also the values and skills to cope with the changing times.

And increasingly, that responsibility of equipping our young is being placed upon teachers. It’s becoming the job of teachers to develop the “whole child”,

not only intellectually but also socially, morally, physically and aesthetically.

In fact, the most important determinant of student outcomes, according to a recently released report on the International Education Roundtable held in July last year, is teaching quality (Barber & Mourshed, 2009).

#### Becoming a 21st century teacher

What does this mean for teaching and teacher education? While the list of future-ready student outcomes has been extensively spelled out in MOE’s Curriculum 2015 (C2015) document, what about the values, skill sets and competencies that teachers should be looking at developing?

These were some of the questions that teacher educators at Singapore’s National Institute of Education (NIE) asked themselves as they surveyed the quickly changing educational landscape. Because inasmuch as teachers need to develop new mindsets and skill sets, our teacher education systems also need to stay one step ahead.

The team at NIE undertook to review and enhance NIE’s teacher education programmes to produce a stronger teaching force, in a way that is responsive to the needs of our schools. Their response is documented in a recent report on *A Teacher Educational Model for the 21st Century* (or TE<sup>21</sup>; Low et al., 2009).

#### A teacher education model for the 21st century

What would *you* change if you could relive your teacher training days?

The TE<sup>21</sup> report articulates six key recommendations aimed at refreshing, updating and strengthening NIE’s model of teacher education. From Initial Teacher Preparation through to Teacher Professional Development, TE<sup>21</sup> seeks to equip current and future teachers with the relevant 21st century skills.

In subsequent issues of *SingTeach*, we will consider how these recommendations can be translated into practice:

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1. Focus on refreshed **values, skills and knowledge** as necessary pre-requisites for the 21st century teacher.
  2. Define a set of professional benchmarks as a framework for developing **teacher competencies**.
  3. Strengthen the **theory-practice nexus** through mentorship and reflective teaching, among other things.
  4. Extend teachers' **pedagogical repertoire** of instructional strategies, modelled after best practices, to keep abreast of changing content.
  5. Develop a high level of **assessment literacy** in response to changing pedagogies, so teachers can effectively evaluate student outcomes.
  6. Enhance pathways and opportunities for **professional development** to make teaching a profession of choice.

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### Why this report is important

With the learner at the heart of its educational goals, the TE<sup>21</sup> report spells out the key areas of development for both teachers and student teachers.

"In preparation for writing the report, the editorial team did a lot of envisioning of what 21st century skill sets and development areas for students and teachers would look like," says Associate Professor Low Ee Ling, who co-edited the report. The team also conducted an extensive literature review and referred closely to MOE's C2015 document.

As a result, "the main recommendations outlined in this report clearly hold the potential to achieve [the] features of exemplary teacher education programmes," writes Prof Darling-Hammond (in Low et al., 2009, Foreword).

### Key recommendations

A particularly important step, notes Prof Darling-Hammond, is the effort to bridge the gap between theory and practice. Strengthening the role of mentorship in the school practicum experience is one way NIE aims to close the gap.

NIE Associate Professors Angela Wong and Liu Woon Chia support these moves. They believe that by developing the competencies and expanding the repertoire of skills of Cooperating Teachers and School Coordinating Mentors, they will be able to better perform their roles in guiding, observing, giving feedback and leading student teachers in reflective practices.

Prof Darling-Hammond also hails the recommendation to develop and phase in portfolio assessments for teachers as "a bold and important move" (Low et al., 2009, Foreword).

### From planning to implementation

There is an acute recognition that "the success of the NIE TE<sup>21</sup> model ultimately lies in the effective implementation of the recommendations put forward" (p. 25).

While this report is mainly for faculty members at NIE, who are at the heart of the teacher education process, the MOE and schools are crucial partners in helping to successfully transform teacher education for 21st century classrooms.

At the end of the day, teachers can look forward to more targeted professional development, while beginning teachers can expect to more effectively transition from NIE to schools.

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## MATH ED

### Seeing the value of visualization

by Ho Siew Yin

*Seeing is believing, or so the saying goes. We depend on our sight for many things in life—using a map to find our way, using a picture to aid recognition, or using diagrams to better describe what our words fail to communicate. In the math classroom, sometimes the solution to a problem is right before our eyes.*

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### Article highlights

- Why is visualization important in mathematics?
- What are the factors that influence students' choice of problem-solving method?
- How does visualization help students in mathematical problem solving?

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### Visualization in math problem solving

Inasmuch as the ability to solve problems is at the heart of mathematics, visualization is at the heart of mathematical problem solving.

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Visualization is the ability to see and understand a problem situation. Visualizing a situation or an object involves “mentally manipulating various alternatives for solving a problem related to a situation or object without benefit of concrete manipulatives” (MOE, 2001, p. 51).

Visualization can be a powerful cognitive tool in problem solving. In the revised Primary Mathematics syllabus (MOE, 2007), it is highlighted as an important skill “essential in the learning and application of mathematics” (p. 13).

This ability to reason visually is increasingly important in the information age. Thus, the role that visualization plays in students’ mathematical thinking and problem-solving experiences has become more significant.

### The research study

A recent study by Dr Ho Siew Yin attempted to provide insights into the use of visualization in mathematical problem solving among primary school students.

She asked 50 Primary 5 and Primary 6 students to solve word problems with a high degree of visuality and difficulty. Here is an example of such a word problem:

*A man plants seedlings along a straight path.  
He plants a seedling every 4 cm along a path.  
The length of the path is 60 cm.  
How many seedlings, at most, can he plant?*

This problem is typical of what students would face in the PSLE exam. The students were asked to solve six such problems in an interview setting.

Siew Yin documented five processes and seven roles of visualization in their problem solving.

### Processes of visualization

Siew Yin noted that the students went through the following processes when solving the math problems:

1. **Understanding** the spatial relations of the elements in the problem
2. **Connecting** to a previously solved problem
3. **Constructing** a visual representation (in the mind, on paper, or through the use of technological tools)
4. **Using** the visual representation to solve the problem
5. **Encoding** the answer to the problem

As part of the problem-solving process, the students would construct visual representations, often in the form of diagrams drawn on paper.

However, Siew Yin also noted that a number of students in the study were creating visual representations that were not helpful to them. Diezmann (2000) describes three types of unusable diagrams:

- Where the diagram is *too small* to represent all the

relevant information in the problem;

- Where the diagram is *too untidy* for the problem-solver to see the elements of the problem clearly; and
- Where there is *insufficient space* around the diagram to extend it.

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### To draw or not to draw?

Primary 6 student, Hao Wei, caught Siew Yin’s attention because he hardly ever used visual representations when solving math problems. Why do students sometimes use visualization in solving problems, while opting not to at other times? Is it a matter of individual preference?

Presmeg (1986) defined a visual method as one that involves a visual image, with or without a diagram, as an essential part of the method of solution. A non-visual method, on the other hand, doesn’t rely on a visual image.

Siew Yin found that students’ use of a visual method in their problem solving was influenced by two factors: (1) the novelty of the problem, and (2) students’ perception of their teacher’s problem-solving preference.

It appeared that students preferred to use visual methods for novel problems and non-visual methods for familiar ones.

For non-novel problems, the students have an adequate knowledge base as well as problem-solving experience. Because they are able to identify the relevant knowledge to apply, a non-visual method is considered a more efficient way to solve the problem. In addition, they are able to apply the same method to solve all problems of a similar type.

For novel problems, however, a visual method is more fruitful as the visual representation helps students to understand the spatial relations of the elements in the problem.

Some students were observed using methods which they perceived as their teacher’s problem-solving preferred method. Hao Wei, for example, felt that his teacher viewed drawing diagrams as a waste of time, and thus used only non-visual methods to solve problems.

Unfortunately, students like Hao Wei are not always successful in problem solving as the non-visual method does not allow them to adequately understand the problem.

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### Roles of visualization

Visualization plays different functions or roles as students use it to solve problems. Siew Yin identified seven roles:

1. To **understand** the problem  
By representing the problem visually, students can understand how the elements in the problem relate to each other.
2. To **simplify** the problem

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Visualization allows students to identify a simpler version of the problem, solving the problem and then formalizing the understanding of the given problem and identifying a method that works for all such problems.

3. To see **connections** to a related problem  
This involves relating the given problem to previous problem-solving experiences.
4. To cater to individual **learning styles**  
Each student has his or her own preference when it comes to the use of visual representations when solving problems.
5. As a **substitute** for computation  
The answer to the problem can be obtained directly from the visual representation itself, without the need for computation.
6. As a tool to **check** the solution  
The visual representation may be used to check for the reasonableness of the answer obtained.
7. To **transform** the problem into a mathematical form  
Mathematical forms may be obtained from the visual representation to solve the problem.

### Developing visualization skills

To help students develop visualization skills, classroom teachers and designers of curriculum materials should first be mindful of the factors that influence students' choice of problem-solving method, and of the processes and roles that visualization plays in mathematical problem solving.

Siew Yin also recommends that teachers increase students' awareness of the three types of unusable diagrams by illustrating the disadvantages of using such diagrams during problem solving.

If visualization is at the heart of mathematical problem solving, then it is vital that both teachers and students see the role of visualization clearly and use it to help them in their problem-solving process.

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### About the author

This article was contributed by Ho Siew Yin <<http://math.nie.edu.sg/people/acad/staffdetail/HoSiewYin.html>>, a Lecturer with the Mathematics and Mathematics Education Academic Group at the National Institute of Education, Singapore. The article is based on her doctoral research.

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## LANGUAGE ED

### Creating lifelong readers

**Ever tried getting your young primary school students to read outside their textbooks? How about getting them to seriously discuss an award-winning literature book? Sounds daunting? It's not only possible but rewarding, says one primary school teacher who has been inspiring students to become lifelong readers.**

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### Article highlights

- What are literature circles?
- What are the benefits of literature circles?

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- How can literature circles be used in the primary school classroom?

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Ask your young students what their favourite books are, and you're likely to get responses like "*Harry Potter*", "*Mr Midnight*", or the name of some comic book.

Do you think these students, given the time and the opportunity, would want to read and discuss "good" literature? Think Roald Dahl, E. B. White, or even C. S. Lewis.

Maybe not. But Mdm Yue Chook Eng has a strategy to get them to do just that.

### Literature for the young

The Senior Teacher at Holy Innocents' Primary School firmly believes in inculcating literacy while letting children have fun. What she has done is to set up what are called "Literature Circles" in her primary school classroom.

A literature circle (LC) is an instructional strategy in which small groups of students talk and think about a common book they read at regular meetings.

Chook Eng begins by drawing up a reading list of Newbery Medal and Honor books. The Newbery Medal recognizes children's books that make distinguished contributions to American literature and "have come to represent the best in children's literature," says Chook Eng. She then lets her students pick the books that they want to read.

Before getting together to discuss these books, students are encouraged to make notes, write journal entries, illustrate and reflect on them. When they have finished reading each book, they share highlights with the rest of their classmates.

### Literature circles work!

Why would you use a part of your valuable lesson time on what sounds like a book club meeting? Well, research shows that LCs do work (Daniels, 2002).

First implemented in Phoenix, Arizona, in 1982, the many positive observations of effective LCs caused literacy educators to consider this approach as one of the most significant trends of teaching students to love reading.

Because LCs are child-oriented and child-driven, students are engaged in, and share responsibility for, their learning. "Children seem to read more when they are independent of teachers," says Chook Eng.

This is especially significant in an age and with an education system that calls for higher-order thinking skills:

Having kids read aloud and answer factual recall questions no longer passes for good instruction.

Teachers now require kids to engage text at higher levels of thinking: drawing inferences, forming hypotheses, making judgments, and supporting conclusions about what they read. (Daniels, 2002, p. 5)

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### Literature circles as a pedagogical approach

Claire Yio, Senior Lecturer with NIE's English Language and Literature Academic Group, has had years of experience in teaching English Language, English Literature and the General Paper.

Of literature circles, she believes that "as a learner-centred or student-led pedagogical approach, it is an effective vehicle through which students respond to the literature they read, become totally engaged in reading, and in providing insightful interpretations of a book."

"In dialoguing about a book, the level of excitement with and the enjoyment of the book is heightened," explains Claire. "Teachers are sometimes amazed with how students think critically, articulate opinions, and provide in-depth analysis of the book, in comparison with their reading a book all by themselves."

"The initial implementation stages are demanding on time," says Claire. "But once literature circles are successfully implemented, the approach takes on a momentum of its own, with teachers having to do less in class, while pupils gain increasing independence and ownership of their discussions."

*Read more about what Claire has to say of literature circles and its use in the classroom on the SingTeach website.*

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### Using literature circles in your classroom

Chook Eng has been using LCs since 2008, with her Primary 3 and 4 classes. She recommends these simple steps for leading an LC (adapted from Candler, n.d.):

1. **Select your books, then let students choose.** Pick about nine books. If you have 36 students, you will need approximately five copies of each book, plus one of each for yourself. Let students choose from your list, and ask them to write their choice down. This determines the book circle they join.
2. **Divide each book into three sections.** If there are 12 chapters in a book, that's about three chapters to read in a week. Decide which day of the week you will meet with each group.
3. **Let students know assignment due dates.** For each book, fill out a section in the form *Literature Circle Assignment Dates* <<http://www.lauracandler.com/filecabinet/literacy/PDFLC/mtgdates.pdf>>. Duplicate copies and cut them into strips. The students use these as bookmarks to help remind them of their deadlines.
4. **Distribute the books.** Allow some class time for silent reading. Give students their LC File. Have students write three discussion questions of their own and answer them. Having them answer a question by the teacher

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also gives you the chance to assess whether or not they have really read their assigned section.

5. **Arrange for an LC meeting.** Follow the steps outlined in *How to Lead a Literature Circle Meeting* (see Resources).
6. **Get students to draw.** Have students illustrate their favourite part of the book and write a caption for the picture. Allow them to share their illustrations during the final LC meeting.

Chook Eng also uses various other activities to supplement her LCs, such as drawing story maps and discussing what students would do if they were a particular character. With slower students, she reads aloud instead of engaging them in discussion. She also limits the use of written tasks that may be too tough for these students.

"I only have a simple aim," says Chook Eng, "to spread the love of reading books!"

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## Resources

Here are some of the resources Chook Eng uses with her literature circles:

- Suggested Reading List
- How to Lead a Literature Circle Meeting
- Ways to Read Chapters
- Sample Activity Worksheets

These may be downloaded from the *SingTeach* website. For more resources, visit <http://www.lauracandler.com/strategies/litcircleblacklines.php>

For more information, you may contact Chook Eng via email: [yue\\_chook\\_eng@moe.edu.sg](mailto:yue_chook_eng@moe.edu.sg)

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# SCIENCE ED

## Using Facebook as a learning platform

***Much has been said about the popularity of online social networking sites like Facebook.com. Very little has actually been researched and written about its use as a learning platform and teaching tool. Find out***

***how you can harness the power of Facebook to teach science.***

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## Article highlights

- What is the potential for using Facebook in teaching and learning science?
- What are some of the benefits of using Facebook for learning?
- How can we avoid the pitfalls of using Facebook for teaching?

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The vast world of online social networking has created opportunities for connecting people and content creation by ordinary citizens. And, one could argue, content creation on the part of students augments the inquiry process so fundamental to science learning.

So, can a social networking site like Facebook aid the learning of science? And just how useful is it as a teaching tool?

## What Facebook can do for you

Created by Mark Zuckerberg in 2004, Facebook quickly rose to become one of the most visited websites around the world, including Singapore ("Facebook most-visited," 2009).

While the social networking site may seem like a hindrance to learning, it is its popularity that makes it a potentially useful learning platform.

"Facebook can be used for informal learning," says Associate Professor Wang Qiyun <<http://qywang.myplace.nie.edu.sg>>, who is currently researching the use of Facebook for learning.

"Students can learn not only from their friends, but also relevant interest groups and discussion forums," he explains. "It even has educational games, which students enjoy playing."

Facebook also has the potential to support various innovative learning approaches, such as lifelong learning, student-centred learning, constructivist learning and collaborative learning (Idris & Wang, 2009).

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## Innovative science learning

Intrigued by their students' penchant for constantly checking their Facebook accounts and commenting on their friends' posts, Science teachers Daphne Tan, Magdalene Tan and Karen Tay decided to explore its potential for learning.

They embarked on an action research project to examine the effectiveness of Facebook as a learning tool. This was part of an ongoing effort by Innova Junior College <<http://www.innovajc.moe.edu.sg>> to study the the use of new media in education.

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More than two-thirds of these students were already Facebook users when they began using the social networking site to teach and revise Chemistry and Biology topics with their first-year students (Tay, Tan, & Tan, 2009).

One group revised the topic of Chemical Bonding through Facebook. A second group was taught topics beyond the Chemistry syllabus via the site. The third group of Biology students was introduced to a new topic—Genetics of Viruses—also on Facebook.

They spent up to 6 months on this endeavour. They also made use of videos and additional Facebook applications, such as Quizzer, Liveblog and Livescribe, as assessment and revision tools.

Surveys before and after their experiment showed that the students were interested in Facebook for learning and for consultation with their tutors. The teachers concluded that Facebook is effective for collaborative learning of science among these pre-university students.

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### Potential benefits

While Facebook is not a formal learning system, it has several features that make it amenable to learning.

- **Active content creators**  
“Facebook creates an online environment where students can be active content creators, not just passive consumers,” says Chemistry teacher Daphne Tan.
- **Integrated platform**  
Facebook also allow different forms of content to be presented on the same platform. For example, students can view videos and animations and then comment on it, all on the same web page.  
  
This is particularly useful in science, where visualization of abstract concepts is important. “This is difficult to achieve with other learning systems,” says Daphne.
- **Learning beyond curriculum time**  
With an online platform, students can review the resources at their own pace. They can also clarify doubts or discuss the topic with their classmates and teacher in a related forum. Thus, learning can continue to take place beyond curriculum time.
- **Adding value**  
Facebook is able to incorporate varied applications such as discussion boards and chat applications. These facilitate dialogue between teachers and students, and among students themselves, and are thus useful for consultation as well as collaborative learning.

Add to these the fact that it is free, and Facebook does have much to offer as an innovative learning tool. In fact, the popular social networking site is now also used to train students for the Singapore Chemistry Olympiad, which

includes Chemistry topics that are beyond the syllabus.

### Potential pitfalls

If you can't beat them, join them! But before you jump on the Facebook bandwagon, Dr Wang and the Innova teachers stress the need for the teachers to know their learners well. This will allow you to maximize the benefits of using Facebook in learning.

“It may not be suitable for primary school children and adult learners,” cautions Dr Wang. “It may be more suitable at the secondary and junior college level.”

As Facebook is primarily a social networking site, using it as a learning platform may also pose privacy concerns to some. Students may be uncomfortable with sharing their private life with their peers, and especially their teachers.

This issue is easily resolved by setting up a separate Facebook account and adjusting the privacy settings, suggest Daphne and her colleagues.

By carefully using what new technologies have to offer, learning in and out of school can be enriched. Every time your students log into Facebook, there is a good chance of getting them to revise their science subjects as well!

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## HOT TOPIC

### Putting the D back in R&D

#### ***Are the teaching and learning practices in Singapore schools relevant to the innovations of the 21st century?***

“We need to put the D back in R&D,” Stanford professor Linda Darling-Hammond is quoted as saying (cited in Viadero, 2009, January).

There is a growing push within education research circles in the United States to move away from garnering “scientifically based evidence” through rigorous experiments—the rallying cry for education research over the past 8 years—towards “development” and “innovation”.

This new “design-educational engineering-development” approach to research and development is focused on effectively dealing with the problems of day-to-day schooling, rather than just pursuing what interests scholars. (Viadero, 2009, June)

It involves designing educational solutions, testing them again and again in different contexts. Or as another Stanford professor put it: “It’s design, test, apply, review, redesign, test, and review again.... It’s more of a systems-thinking approach.” (Helen Quinn, cited in Viadero, 2009, January)

This is a goal that researchers at NIE are committed to as well. Our “push” towards such R&D work is the pressing question:

#### **Are the teaching and learning practices in Singapore schools relevant to the innovations of the 21st century?**

“The recent reports of the Curriculum 2015 and PERI commission both emphasize the need for holistic education, where learners need to be enculturated with not just disciplinary content but social and communicative competencies,” says Professor David Hung, Associate Dean of Education Research at NIE.

In the past year, colleagues at NIE’s Office of Educational Research (OER) have been strategizing on how to engage and conduct educational research relevant to MOE’s initiatives.

“While numerous efforts have been made in the direction of 21st century learning, through research conducted by NIE’s Centre for Research in Pedagogy and Practice and the Learning Sciences Lab in the past 5 years, there is a consciousness that such pioneering work has now to be made more pervasive in our local schools,” adds David.

He highlights the translation and sustaining of research innovations as another important area of research work.

“We cannot assume that when OER successfully implements a 21st century intervention in a particular school and this effort will naturally translate into other schools, or that the original effort will be sustained,” explains David. “We need to understand how to build a larger pool of expertise in enacting tested models of 21st century learning and finding out how they can be re-contextualized in other settings, schools, and cohorts of students.”

In research jargon, this is known as “translation science”. Translation work requires multiple stakeholders—MOE policy makers, school leaders and teachers, NIE faculty—to be involved in the research innovations as early as possible. It is also necessary to engage these participants in dialogue around research designs, curriculum and other assessment issues.

For Anthony Bryk, President of the Carnegie Foundation for the Advancement of Teaching in the US, this process begins with identifying “high leverage” educational problems (Viadero, 2009, June). The Carnegie Foundation is spearheading efforts to develop a “use inspired” research programme, using existing knowledge—and, in some cases, old-fashioned practical know-how—in new and relevant ways to address real problems in schools today.

In Singapore, the NIE has a slew of new research projects aimed at deepening our understanding of the logic of teaching, classroom interaction and student learning in Singaporean classrooms; and identifying the skills, understandings, dispositions and values that young people are likely to need to effectively negotiate 21st century institutional environments.

“The vision around Curriculum 2015 is exciting,” says David. “We need to rally around this initiative and make it an increasing and progressive reality for our students.”

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