TEACHER ED

Reflection: Thinking About Doing

Much has been said about the value of reflection. But how can it be effectively put into practice? Meet Mr and Mrs Gerald Wong, a couple who are committed to the practice of reflective teaching. They share with us how they have made reflection a part of their lives.

Article highlights

- Is there more than one way to practise reflection?

- What are some benefits of reflective teaching?

- How can reflection bridge the theory-practice gap?

Gerald and Elaine Wong are both busy teachers. Gerald teaches Physics in a junior college; he is in his second year of service. Elaine has been teaching in a primary school for 5 years, and is currently enrolled in NIE's Management and Leadership in Schools (MLS) course.

Gerald and Elaine have discovered that learning does not come so much from our experiences as from the *reflection* about these experiences (Low, Taylor, Joseph, & Atienza, 2009). They have found a number of useful ways to put this concept of reflection into actual practice.

A personal practice

Elaine practises reflection as part of a personal and professional discipline.

Every Friday afternoon, she schedules time to reflect on her classroom teaching even as she plans her lessons for the next week. While this is required by the school, she relishes the opportunity to take time out to think about her teaching.

She also keeps a journal of her own personal reflections, which she pens 2–3 times a week. "I feel that it's good to sometimes ask yourself why you are teaching. Also because teaching is sometimes quite hectic, and as you deal with certain events or students, you need to think deeper about lessons learnt from each day's encounters."

In the MLS course, Elaine is learning how to engage in a deeper level of reflective teaching. "I used to journal my feelings. But for the course, I have to synthesize what I'm learning in my reflections. It's looking at issues and applying theories that I've learnt, to come up with views and to see how I can be a better leader or teacher in that area."

Growing through interacting

Reflection can also take place in interaction with others.

Gerald has found it useful to interact with someone more senior about his teaching experience. He submits his reflections on a weekly basis to his subject head, who then comments on what he has written.

For his reflections, Gerald uses a format prescribed by his college. The teachers are encouraged to reflect on focus areas that are aligned with the core competencies of the EPMS, such as teaching and learning, pastoral care and well-being, and professional development.

Gerald admits that he was initially resistant to the idea of reflections being formalized and made mandatory. But this year, he decided to be more diligent and deliberate about it. He sets aside at least half an hour on Friday afternoons, and makes sure he reflects meaningfully on at least two focus areas, instead of simply listing activities.

Gerald has found the process helpful to his growth as a teacher. He especially appreciates the responses by his subject head. These are usually honest comments penned in the margins of his reflections.

"Actually it takes some experience to reflect. It takes quite a bit of practice, otherwise you end up getting stuck—you see something happening but you cannot draw the next conclusion. I think that's where the interaction helps."

Gerald has gone one step further, by ensuring that his reflections don't stop there. He tries to come up with concrete action plans to redress the issues he's thinking about. Three questions guide his reflections: "What?", "So what?" and "Now what?"

A model of reflective teaching

Reflection is identified as one of the core practices for strengthening the theory-practice nexus—the gap between what is learnt in teacher education programmes and its

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effectve practice in the classroom (see Recommendation 3 of the TE[21] report, Low et al., 2009).

While the importance of reflection is not new to education, the techniques of reflective practice are relatively recent. Here's a useful model for structuring your reflections (Low et al., 2009, p. 72):

- **Observe** *What happened?*
- **Reflect** *Why?*
- **Plan** *So what?*
- **Act** *Now what?*

This cyclical process facilitates reflection in action and on action. Practised over time, as a planned and structured exercise, it helps to build personal-professional knowledge.

As a couple, Gerald and Elaine also take time each day to interact with each other about their day and the challenges they face on the job. These "verbal reflections" have become part of their daily interactions.

They make a conscious effort draw conclusions and not just complain about their day. Though Elaine may have been teaching for longer, she says Gerald helps her to see issues from a different perspective.

A critical practice

In planned and structured reflection, what we do is try to mentally restructure an experience or a problem (Korthagen, 2001). Actively reflecting on our own practice can help us see where to improve.

"The reflection helps to anchor me down, to know which direction I should be moving towards," says Elaine. "Because you hear many voices from different stakeholders, different teachers, different parents—you need to sit down and reflect on what you're doing, on your principles."

For Gerald, as a relatively new teacher, he feels it is necessary to interact with someone as part of the process of reflection. "It gets you to organize your thoughts," he says. "Because as a new teacher, every experience is new, so you tend to be bombarded by a lot of new things."

Reflection may require quite a bit of time, but Gerald and Elaine believe it is time well spent—and they say it gets easier with more practice.

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Read more about the TE[21] recommendations in our previous issues of SingTeach.

MATH ED

Are You Game Enough?

by Joseph B. W. Yeo

Children love games! But it can be more than just fun and games when mathematically rich games are used in the classroom. Learn how games can help your students acquire the skills of mathematical investigation.

Article highlights

- How can mathematically rich games aid in learning?
- Do students know what and how to investigate when faced with a math problem?
- What are the thinking processes students use in investigating?

Many math educators believe in making math real to students. Playing mathematically rich games is one way to engage both their hearts and minds.

Such games are very real to students because the outcome—whether they win or lose—matters to them (Ainley, 1988). They may become more interested in looking for a way to win the game (Civil, 2002).

A winning strategy

The fact is, we all want to win! And when people don't know how to solve a problem, they will start investigating and exploring various solutions. Problem solving and investigation are essential skills in our daily lives (Carraher & Schliemann, 2002).

Likewise, finding a winning strategy for a game involves the application of problem-solving heuristics. For example, we can solve problems by working backwards or by considering all possible scenarios.

I distinguish between a *sure-win strategy*, which will ensure a win for a player, and a *winning strategy* that maximizes the chance of winning for a player if a sure-win strategy does not exist, such as in the game *Fifteen* (described below).

Investigating mathematical investigation

In a recent study, I used mathematical games to examine the nature and development of cognitive and

metacognitive processes when students engage in mathematical investigation.

A group of 20 Secondary 2 students was presented with a game called Fifteen (Mason, Burton, & Stacey, 1985). The rules of the game are simple:

> Place 9 discs marked with the digits 1 to 9 on the table. Two players take turns to pick one disc from the table. The first player to obtain the sum of 15 among any 3 of his discs wins.

The students were tasked to explore and investigate. What they were *not* told is that there is a winning strategy.

I wanted to see if they knew what and how to investigate, and if they understood what a winning strategy or a sure-win strategy is, among other things.

Knowing how to start

When faced with this game, most of the students did not even know where to start. The idea of finding a winning or sure-win strategy was alien to most of them.

Many mathematics educators are surprised why students do not have a correct conception of a winning or a sure-win strategy. I suggest that this is because most of the games that students play in their daily lives have no such strategy, so such an idea contradicts with their real-life experiences.

This finding is in line with what Civil (2002) found out when she played another game called *Nim* with her students. In this game, there is a sure-win strategy for the player who starts first, but her students mistakenly thought that their ability to win depended on the other players' moves.

Winning the game

So, what is the winning strategy for Fifteen?

To solve this game, the students needed to be familiar with the Magic Square and Tic Tac Toe—games they have all played in their childhood.

Magic Square

Magic Square is something that many of our students would have learnt in primary school. In a 3-by-3 Magic Square (see Fig. 1), all three numbers in each row, column and diagonal add up to 15.

Figure 1. Magic Square.

Some of the students did manage to link this game to the Magic Square, but they failed to consider all the possibilities: Are there anymore combinations of three numbers whose sum is 15, other than the eight combinations as shown on the Magic Square?

To win this game, you need to prove that there are no more combinations. Only then can you apply the winning strategy for Tic Tac Toe to the Magic Square. But none of the students were able to link this game to Tic Tac Toe. (In fact, many people do not realize that there is a winning strategy for Tic Tac Toe!)

In the game of Fifteen, a winning strategy for the player who starts first is as follows:

- **Turn 1**: Pick the number 8. If the second player does not pick 5, the first player wins!

- **Turn 2**: If the second player picks 4 the first player can win by picking 6, which will force the second player to pick 1 (to prevent the first player from winning by 8 + 6 + 1 = 15).

- **Turn 3**: The first player can then pick 2 and he will win in two ways: 8 + 2 + 5 = 15 *or* 6 + 2 + 7 = 15, which the second player cannot prevent.

This looks very confusing but it becomes clearer when you try the above moves as if playing Tic Tac Toe on the Magic Square (see Fig. 2).
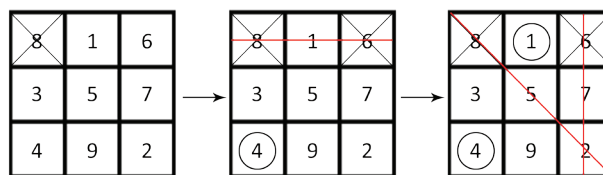

Figure 2. The game of Fifteen.

The challenge, of course, is to play this game without drawing a Magic Square in front of you, to prevent the other player from knowing the winning strategy. This makes the game a lot more complicated and interesting.

Processes for mathematical investigation

What are the thinking processes involved when students play mathematically rich games?

To investigate the winning strategy for a game, students have to start by examining specific scenarios or cases (*specializing*). The next step involves formulating hypotheses or conjectures (*conjecturing*) and testing them. If the conjectures are proven correct (*justifying*), they can then be considered as generalizations of the specific cases (*generalizing*).

These are the four core mathematical thinking processes described by Mason et al. (1985).

For the game Fifteen, if the students are somehow able to see a link between the game and the Magic Square,

they would then have some conjecture of how they can win. By confirming it, they can then generalize this to a wider number of cases.

Playing mathematical games such as Fifteen is not just about winning and losing. It is a great way to enrich the learning of math. Plus, it's a lot of fun!

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Further readings and resources are available on the SingTeach *website.*

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LANGUAGE ED

Let's Talk About Teaching Tamil

Mandarin. Malay. Tamil. These three languages are often lumped together under the umbrella term of "mother tongue languages". One of these languages requires more attention to speaking, and another to reading. Do you know which? And are your teaching strategies and tasks appropriate to the needs of the particular language?

Article highlights

- Is one mother tongue language more difficult to learn than another?
- How can learning tasks be redesigned to suit the language?
- How can drama be used in the teaching of Tamil language?

Many assume that the same teaching and learning strategies can be applied to all mother tongue languages. As a result, language reforms in Singapore have tended to look to the Chinese language review (Ministry of Education, 2004) to "lead the way" (Lakshmi, Vaish, & Gopinathan, 2006).

While there are some commonalities to second language teaching, a uniform approach cannot work for all languages, says Dr Seetha Lakshmi, Associate Professor with the Asian Languages and Cultures Academic Group at NIE.

"Each language has its own unique characteristics," explains Seetha. "The process of familiarization of each language script is not same."

Comparing the mother tongue languages

The Malay language has a Romanized written script. This means that Malay words are essentially transliterations into English letters. "Once you know the alphabet, it's easy to write anything," says Seetha.

Chinese and Tamil scripts, however, are not Romanized. Chinese students tend to have more difficulties with reading and writing, compared with speaking, because of the *logographic* nature of the language. "In Chinese, you can't just spell out the word," explains Seetha. "Students have to memorize the whole picture that represents the word."

As a result, the *Report of the Chinese Language Curriculum and Pedagogy Review Committee* recommended an "early *reading* approach" for Chinese (MOE, 2004, p. vii). With the early use of *hanyu pinyin*, a Romanized phonetic system, Chinese students now have a headstart in learning to read and write as this helps them to recognize more Chinese characters at an early age.

But for Tamil, it's actually the converse. Tamil students tend not to have as many issues with reading and writing as with speaking. Thus, Seetha recommends an "early *speaking* approach" to teaching the Tamil language.

Focusing on speaking

It seems that our Tamil students are not proficient in the language because they do not speak it enough. They score well on their Tamil written exams as they are trained to be exam-smart, says Seetha. However, when talking with friends and family members, they tend to switch to English rather than speak in Tamil.

Seetha also attributes this to the lack of exposure to spoken Tamil both in the classroom and in the community. This is partly due to the Tamil curriculum's emphasis on using a "pure" version of the language, rather than the more informal spoken Tamil.

With the revised Tamil language syllabus, there is a need to design learning tasks that place a greater emphasis on speaking. In addition, we need to consider redesigning learning tasks with a focus on helping students to transfer the use of the language to real-life situations.

Drama in the Tamil classroom

One way of getting students to speak more without feeling awkward or inhibited is through the use of drama. The positive impact of drama on language learning has been substantially researched.

Drama lends itself naturally to increased oral communication as participants are forced to verbalize their thoughts. It allows teachers to create learning opportunities that are:

• **Authentic**: It creates a real-life context for meaningful interaction.

• **Accessible**: It provides a non-threatening environment for extended speaking.

• **Active**: It engages the whole class in an experiential learning activity.

• **Attractive**: It makes language learning interesting and enjoyable.

In particular, Seetha and her colleagues recommend the use of *process drama* as a medium of instruction. This approach to drama focuses on the *process* of using language, rather than on the product (Lakshmi et al., 2006).

In a research project by the Centre for Research in Pedagogy and Practice on process drama (Stinson, 2007), teachers found that drama quickly offered opportunities to increase the quantity of language spoken. Even students who were normally quiet or constrained by their lower language ability were keen to participate.

There was evidence that the continued and careful use of process drama contributed to improved oral communication. The participating students reported greater internal motivation to speak and speak well.

Using process drama to teach Tamil

Unlike traditional conceptions of drama, there are no scripts or rehearsed performances in process drama.

Instead, the students and teacher work together within designated roles to create the story.

When carefully structured and led by the teacher, process drama allows for deep understanding, expression of diverse points of view, and problem solving as the drama unfolds. Students operate in their roles to solve problems and investigate issues; they deal with events and interactions as they happen.

Process drama may follow a structure like this (adapted from Stinson, 2007):

1. **Establish a pretext**, that is, a starting point for the creation of a dramatic "world". It may be a story, an artefact, or even a piece of music.

2. **Establish roles** for both students and the teacher in the drama. Students can take on purposeful and "expert" roles in the drama, for example.

3. **Establish the narrative**. As the story unfolds, the teacher can add a complication to the narrative, to move the drama to a climax and to further engage students.

4. **Resolve the narrative**. The participants need to tie up the threads of the dramatic situation and arrive at a resolution that is satisfactory to all.

5. **Reflect and debrief** students on the preceding experience and identify what has been learnt through the process.

While an understanding of basic drama conventions helps, the skills for process drama are not difficult to pick up.

Process drama can be easily applied in the Tamil language classroom. "Process drama makes use of real-life situations, without creating any tension or stress," explains Seetha. "In a way, it is creating the home, the outside world, in our Tamil classroom."

Bringing in authentic life-related situations will add more value to the use of process drama, says Seetha. She suggests some situations that can be used in class:

•   Tell your parents what you wish for a birthday present

•   Ask them to bring you on a short holiday to Malaysia

•   Encourage your classmate to participate in a school competition

•   Discuss plans to go to your friend's house after school to do group study

•   Talk to a shop vendor and order a takeaway lunch

•   Call your cousin on the phone and invite him to stay over at your house during the school holidays

"In these kinds of conversations, students need to use day-to-day language to communicate with others for functional purposes," says Seetha.

So, if you're looking to add some life into your language classroom, why not act on it now!

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SCIENCE ED

Science Education for Gifted Learners

Who are the gifted in science? Are they necessarily the straight-A students or the all-round high achievers? Could these "gifted students" be found among those at the borders, the school dropouts even? Professor John Gilbert helps us to rethink the idea of the gifted learner.

Article highlights

• Are we doing enough to develop high-ability students in science?

• What does it mean to be gifted in science?

• How can we identify and develop these gifted learners?

Science is everywhere. It pervades our personal and professional lives. And it is taught and examined in school curricula around the world. But has our science curriculum overlooked those who are gifted in the subject?

In recent years, the school science curriculum has evolved to provide "science for the citizen". It is no longer the domain of the scientist—science education is and must be accessible for all!

While this development has benefitted the man in the street, the fallout is that many "would-be" scientists are increasingly being drawn away to other fields. This is a loss not only for the scientific field but for society at large.

Professor John Gilbert—eminent science researcher, educator and award-winning author—describes this as a problem of "neglect".

"You've got to have scientists," he says. "We have to do something to pull them back!"

The question for educators at the K–12 levels is: How can we identify those who have a talent and aptitude for science? And once identified, how do we develop this ability in science?

Redefining "giftedness"

Part of the problem, perhaps, lies in the way we define "giftedness".

"Indeed in most countries, everyone thinks giftedness means being able to do the existing curriculum faster, getting mastery of the content more quickly," observes Prof Gilbert. But he suggests a radically different idea.

"Giftedness surely has got to mean that you're intellectually innovative," he posits. "Giftedness is about being creative!"

Creativity, you ask? What does creativity have to do with excelling in science?

"It is about being able to attack, or even identify, problems that people have not identified before. Opportunities! And to generate the science to explain them, and the technology to explore them."

Identifying creative learners

Unfortunately, there are no foolproof tests for identifying creative people. "You can do the tests, and it sort of narrows the field, but you can't tell who's creative."

The best way to identify creative people, he says, is to give people the *opportunity* to be creative.

"Give them questions to solve—preferably increasingly open-ended ones—problems that people don't know the answers to," suggests Prof Gilbert. Provide extended opportunity to work on their own to solve a menu of problems with increasing difficulty.

And that's where the real test begins. The gifted (a.k.a. creative) learner will display the following characteristics:

• **Interest**: They will demonstrate an inclination towards problem solving.

• **Intrigue**: They will ask questions, difficult ones!

• **Imagination**: They will come up with creative solutions.

• **Persistence**: They won't give up, even in the face of difficulty. They are self-directed and motivated.

- **Purpose**: They will have tenacity of purpose and a sense of ownership.

This "Gilbert recipe for giftedness" may be exploratory and tentative, but it allows teachers to see how their students will perform. More importantly, it allows students opportunity to *show* us their creativity.

"You'd be surprised what kids will come up with!"

Where does creativity begin?

Prof Gilbert gives the example of Harold Kroto, recipient of the 1996 Nobel Prize in Chemistry, as someone who demonstrates "giftedness" as he defines it. As a lad, Kroto worked at his dad's workshop on weekends, and gradually found himself solving the problems they had at work. He was naturally interested in creating solutions.

Or consider Jamie Oliver, a high school dropout who has carved out a successful career as a celebrity chef. He would never have been considered gifted by any school's definition. Today, however, his ability in his chosen field is undisputed.

"It doesn't necessarily say that you can't be a high attainer and not be gifted—don't get me wrong," says Prof Gilbert. "But relying exclusively on high attainment is foolish."

So, how does our education system fare in developing gifted learners?

"I think the current system doesn't do anyone any favours, because people who are labelled as gifted think that they are. They get high marks, but they may not be gifted."

Test scores can be viewed as a pre-selector to sieve out those with creative potential. This can then be followed with project inquiry work, to see how they fare, before investing further resources on them. And it will involve a substantial amount of investment as well as a high level of commitment on the part of the teachers.

Today, Prof Gilbert spends much of his time teaching 4-year-olds in London. He's teaching them about models and representations—and loving every moment of it. "I think you can start earlier on with this," he says, "I think you *should* start earlier on."

Teaching gifted learners

Prof Gilbert makes a distinction between teaching and mere instruction. "Teachers want answers, they want algorithms, they want things to do—that's not teaching, that's instruction!"

"Teaching gifted children is very demanding," he warns. "It is very little about telling them things and an awful lot about asking them questions, probing what they understand, and getting them to suggest where they might go. These are very high-level skills in a teacher."

He recalls his first day as a teacher, fresh out of graduate school. Facing a class of bright 13-year-olds who would complete the A-levels in 4 years, he began by asking where they would like to start. He was taken aback by the response: "I think we should start with some of the fundamentals. How about…thermal dynamics?"

Prof Gilbert's challenge to teachers is to "push ables". For example, he says, "I would like to see much more inclusion in the school curriculum of extended work."

"I'm not saying teachers should just go to the back room and drink tea. We'll give support. And you look at how well they get on—those who make progress with their problems, who show tenacity, who use skills—those are the gifted people."

Perhaps the next winner for the science Nobel Prize is in your class. If we adopt the Gilbert recipe for giftedness, we'd do well to start thinking of creative ways to re-engage them in science.

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HOT TOPIC

Relating Research to Classroom Practice

by Peter Taylor

In light of the issues of translating theory to practice, we are left seeking answers that are current, applicable and research-based, all at once. Professor Peter Taylor shares his thoughts on the relevance of research to teacher learning in today's classroom.

My Collins Dictionary suggests that the essence of research is systematic inquiry. On the other hand, my Oxford Dictionary of Quotations includes the following, attributed to Mark Pattison in a work published in 1875:

> In research the horizon recedes as we advance, and is no nearer at sixty years than it was at twenty… And research is always incomplete.

I think of research as a form of *disciplined curiosity*. The discipline comes from adherence to a particular paradigm or world view, as well as the particular theoretical lenses to view and reflect on the world. I draw on a range of theories associated with learning—individual, group and organizational.

My approach to research is based on the pragmatist paradigm of social science, a paradigm represented in the work of John Dewey. This paradigm includes the view that human beings are interpreting beings, and every interpretation is an interpretive rendering or portrayal.

The goal of a pragmatic approach to educational research is not to reach some ultimate truth (as represented in positivist views of science) but the pursuit of *increased understanding*, *informed intuition* and *improved practice*.

So what relevance does research conducted through this approach have for classroom practice?

At a fundamental level, research brings an "external" eye to the systematic inquiry.

My approach is *systematic* in that it draws on a coherent theoretical perspective, and uses that theory as the basis for experiencing, analysing and describing practice. By implication, it also provides a way to evaluate practice and to recommend ways to improve it.

Therefore, my research tends to involve immersion in the context that is being researched, immersion that necessarily introduces my theoretical and professional understandings and methods to the context.

In turn, those understandings and methods are reshaped and refined through both the process of interpretation and the subsequent conversations through which contextualized intersubjective agreements are achieved.

I like to think that this process both challenges and enriches the shared meanings available within the communities of practice in which I conduct my research.

Let me illustrate this with reference to a research project in which I am currently engaged. It involves an invitation from a secondary school in Singapore to "validate" its attempt to achieve curriculum reform. This involved a systematic attempt to:

- understand what the school attempted to achieve, through reviewing statements about the rationale for the curriculum change, as well as documents that provided an overview of the intentions;

- interview "curriculum leaders" to understand their interpretations of those intentions, and the actions they took to respond to them;

- observe classroom practices to develop descriptions of what is actually happening; and

- interview teachers and past and present students to understand their experience of those practices.

While we, as researchers, have taken our theory-rich understandings into these activities, we have re-developed some of those understandings. We have also had to develop ways to express these contextualized understandings to the stakeholders in that setting—school leaders, teachers, students and parents.

Our work is seen as highly relevant by those within the community of practice. Its relevance acknowledges our status as *outsiders*, capable of bringing a fresh yet disciplined perspective to their practices—always working *with* rather than *on* the community.

It acknowledges our privileged position as *observers*—we have the time to systematically observe, record and reflect on the routine patterns of behaviour that uniquely characterize the community.

It expresses the contribution we can make through adding to, and challenging, the shared language of the community's discourse. And it expresses the value that we can add through recommending improvements to those routine patterns of behaviour and discourse.

Educational research can be an extremely valuable complement to the demanding everyday work of classroom practice.

Learning through practice tends to result in the consolidation and routinization of understandings, behaviours and procedures. These make schooling feasible and efficient.

Research can challenge and disrupt those routines and understandings in informed, disciplined and systematic ways, opening the possibility of new routines and new understandings. This makes change possible.

We need both routines and change, especially in the 21st century.

About the author

Professor Peter Taylor is with the Centre for Research in Pedagogy and Practice at NIE. He is interested in teacher learning, the design of new learning environments, and innovation and change in educational settings.