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RESEARCH within REACH

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HotTOPIC

When Learners Want to Learn

Thinking about learning and teaching has evolved over the years. Today, we think of students as agents of their own learning. Professor Scott Paris tells us why it is important to cultivate engaged and motivated learners.

Q: What do you think is the future of classroom teaching and learning?

A: In traditional notions, teaching was delivered by instructors and learning was acquired by students. More people now recognize that students' internal motivation and intrinsic knowledge of the topic is very critical for deep learning.

There are two important features. One is the notion of *agency*—that students see themselves as agents of their own learning. Their self-beliefs are important.

Students' understanding of their own roles as confident agents shaping their own learning, in directing their own effort and repairing their own problems, is critical so that they don't depend on teachers to tell them what to do. They don't depend on external motivation like marks and rewards to learn.

The other is the sense of *identity*. As they begin to identify themselves as competent and successful learners, it helps them exert appropriate effort. It also helps them create distinctive perceptions of their own competence in different areas.

Q: How does this understanding change teaching and learning?

A: We are asking teachers to pay attention to students' views about themselves, about what they are interested in, about what they think they are good at. As teachers understand students' notions of their agency and identities, this will help them understand how students adopt different coping strategies.

Particularly with the failing students, they often have negative ideas of their own abilities or identities. These negative attitudes can actually make students stop trying and yield to a self-defeating approach to education.

Q: How can we motivate students to take charge of their own learning?

A: If you give students opportunities to be independent, to be engaged, to pursue their own interests, then they will be more motivated. Some people call it *autonomous learning* or *self-regulated learning*.

More people now recognize that students' internal motivation and intrinsic knowledge of the topic is very critical for deep learning.

- Scott Paris,
Centre for Research in Pedagogy and Practice

In this issue

Motivated to Learn

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As students develop an interest in an area, the most important thing is to give them freedom to explore it. Teachers can do that by allowing opportunities in the classroom for independent research—allow them to explore their own interest, develop deeper knowledge, and really give them the independence to seek that.

When students have the ability to do that, we find they persist longer in the face of difficulties. They show more initiative and curiosity, and develop a greater sense of confidence in their ability.

So the self-efficacy of learning and discovering reinforces their motivation to learn because it shows that their efforts are successful. This cycle of effort is what teachers need to create so that students feel confident.

> As teachers become more expert at knowing how to adjust to different situations, they gain a sense of self-confidence.
>
> - Scott *on how teachers can be more motivated*

Q: What do you mean by "self-efficacy"?

A: It is understanding that you *can* do something and also that you *should* do something. It is not just the confidence that you can do it but also the knowledge that you ought to do it and of what you need to do.

The feeling of self-efficacy motivates people. If you think about what you are good at, you have the sense that I know how to tackle this problem, I know the different strategies that are available, and I can figure out which ones are appropriate.

That is the kind of feeling you want your students to have when you give them a new or an ill-structured problem. They approach it with the attitude that they have the tools and strategies to solve the problem and that they can do it.

Q: How can we help teachers feel the same way about the way they teach?

A: All of us need to acquire the same kind of independence and self-regulation. It is hard for teachers because they have so many constraints and so many things to do. Like students, they are often driven by instrumental motivation.

We need to give teachers opportunities for reflection and professional development, so they recognize that they need to direct their own motivation. They need to be selective, set priorities, manage their time, choose goals that are important for their students.

Teachers who have a sense of self-efficacy know they can't do everything, so they plan things throughout the year. They plan different things for different students. And as teachers become more expert at knowing how to adjust to different situations, they gain a sense of self-confidence.

It is professionally motivating for them to work together as a community and share the secrets of how they all become successful—different techniques for teaching, different opportunities for stimulating students' interest, sharing the things that work for them.

As you gain this sense of self-efficacy, you have a growing sense of agency and identity, so that you feel I can do this and I can learn what I need to learn. When you have that as a teacher or as a student, you are confident you can accept new challenges.

Scott Paris is Professor and Principal Research Scientist with NIE's Centre for Research in Pedagogy and Practice. His research interests include metacognition, self-regulated learning, educational assessment and reading comprehension.

ScienceED

When Failure Spells Success

by **Suneeta Pathak and Beaumie Kim**

A lesson can be successfully carried out and yet be unproductive in terms of learning. Especially when it comes to pair work, teachers need to seek a balance between the work going unguided and dependence on teachers' help.

Article highlights

- How can pair work be made more productive?
- How much help should teachers give and when?
- How can productive failure enable better learning?

Pair work is quite common in Science classrooms, especially in the science labs. While completely unsupervised pair work may not lead to targeted learning, if too much help is offered, the basic purpose of pair work—collaboration, mutual reflections and explorations—is defeated.

Productive Failure in Science Learning

Educators and researchers today are realizing that success should not be seen as the only goal of the educational process. While success is a desirable pursuit, if success is seen as the only outcome, learning may not be lasting.

Many research ideas have provided interesting directions on when to provide expert guidance in collaborative learning. One such idea is *productive failure* (Kapur, 2008). Good teachers understand that students learn by mistakes and failures. The productive failure idea goes one step further, by intentionally building in such fruitful "mistakes" and "short-term failures" in the learning process.

Using two examples of pair work—one that is productive and other that is not—we discuss an idea called "learners' productive failure" in technology-enhanced science learning (Pathak et al., 2011).

Working with a computer model, the pairs were tasked to develop an understanding of the physics involved in Ohm's law. One pair was given a worksheet, where steps were given to answer the main question. In this case, they received scaffolding early on. The other pair was given the same task without any guiding questions.

Unproductive Success

In the interaction below, the pair is filling in values on the worksheet, calculating and verifying equations. This example shows that students may give you the correct answers but may not learn much in the process. Such cases amount to a failure in terms of generated learning.

Jen: 1.26 (*reading current value*)… 1.3, (*They re-run the model with same parameters to get the current value and are seen writing on the worksheet*)
Jen: 1.0, (*referring to voltage value*) ready? 2.63+2.45 divided by 2. (*writing down the value on his handout*)
Jen: You do it…we manipulate the equation
Jen: "Why is it so?" … according to Ohm's law, it states that RI=V, right? (*asking Mike, looking at Mike*)
Mike: Yes, RI=V
Jen: Hence we can reach that conclusion… current goes up, you see…
Mike: We still can make that conclusion. (*Smiling and looking at Jen's handout*)

The pair takes each measurement twice and calculates the average. They are focused on getting the measurement "correct", manipulating the "recalled" equations to conclude what they already know, then exploring what makes Ohm's law appear the way it is represented mathematically.

Their verbal and non-verbal behaviours show an urgency to reach a conclusion. They do not seem to be engaged in any effort to know how the movement of electrons contributes to definitions of current and resistance. They want to take the shortest route to success, but in that attempt, they forego the reasoning process that is crucial in science learning.

Productive Failure

Next, we see Ray and Ben doing the same experiment, but their focus is on observing, understanding the graphs, and communicating their understanding and confusions.

Ray and Ben focus on two instances of the graph—when the current drops and when the current is stable. They relate the information to the question but are unsure of an appropriate answer.

Ray: It goes down, see, you cannot say that the current will go down, what I will write is, when collision rate increase… you can very steadily say that current goes down from 7.26 to 2.26. (*Looking at screen, talking to Ben.*) Why it is low? (*Looking at screen, asking Ben*)
Ben: It's because when electrons collide, current drops. When you notice this less particle thing, it goes up, when there are more electrons colliding, it goes down. (*Moving his head close to screen, talking to Ray*)
Ray: So when electrons collide… (*Focusing on screen*)
Ben: Current drops.
Ray: The current falls… (*Writing*) "How would you…" (*Reading the question*) So you just need to explain why it falls? Or you need to explain why it collides
Ben: Yeah… why it collides and falls… No idea

Traditionally, this would be considered a "failure". Ray and Ben have failed to understand that although the instantaneous current is fluctuating, at an aggregate level, the current is constant as expected in Ohm's law.

Good teachers understand that students learn by mistakes and failures.

- Beaumie Kim
& Suneeta Pathak,
Learning Sciences Lab

About the authors Suneeta Pathak and Beaumie Kim are with the Learning Sciences Lab at NIE. Suneeta is a Research Fellow with the project on "Designing Productive Failure". Beaumie is interested in making the connections between learners' activities and experts' practices.

We argue, however, that such instances of failure are more productive and germane to new learning. The change of "or" into "and" is not just a language issue; it shows an effort at acquiring new knowledge and trying to connect it with prior knowledge.

Charting a Productive Learning Path

Sometimes learning isn't just about proving the correct or required answers. The process of arriving at these answers—and the struggles—is critical as well.

As teachers, we need to consciously encourage our students to chart a productive learning path, even if it involves failure. These are some actions a Science teacher can take to encourage productive interaction.

1. Identify students who are taking a shorter route to success. These students will try to recall rather than process the information. Guide such students away from a superficial success path.
2. Identify students who are struggling on the learning path. Such students may not reach the expected answer in a short time; sometimes they may not reach the expected answer at all. Encourage them in their efforts, rather than focus on their outcome.

Ultimately, the aim of pair work is not about the expected answers but enabling students to craft their own learning path.

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LanguageED

Self-efficacy and Self-regulation in Biliteracy Learning

by Lawrence Jun Zhang

Our pupils are required to learn two languages in school, but not all of them are not equally engaged in learning both languages. When teachers understand self-efficacy and self-regulated learning, we can help our pupils learn to read and write effectively in both languages.

Article highlights

- What are self-efficacy and self-regulation?
- How can we apply these concepts to language learning?
- How can we enhance pupils' self-efficacy and self-regulation skills for biliteracy learning?

About the author Lawrence Jun Zhang is Associate Professor with NIE's English Language and Literature Academic Group. This article is based on his project "Enhancing Singaporean Students' Motivation, Efficacy, Engagement, and Self-regulation for More Effective Bilingual/Biliteracy Learning".

You might be very familiar with the following scenarios:

> John is not interested in Mandarin and always dozes off in his Chinese class. He sees no point in learning a language he finds too difficult and for which he has never scored well. He communicates with his friends in English but his English test scores are not fantastic either. His teachers think he is a poor Chinese learner.
>
> Diana is a different case. She loves Mandarin and always aces her Chinese class. She is most confident in Mandarin, which is the language most often used at home. She has received very positive comments from both her English and Chinese teachers.

Diana is not only bilingual but also biliterate. Part of the reason for her success in Chinese and English, and John's lack of interest in Chinese and relative stagnation in English, has much to do with self-efficacy and self-regulated learning (SRL). The good news is that the solution to John's problems is within the teachers' control.

The Role of Self-efficacy and Self-regulation

Teachers can help learners like John. But first we need to understand the role of self-efficacy and self-regulation in pupils' language learning.

What is self-efficacy?

Self-efficacy is a person's belief in his or her ability to succeed in learning. Psychologist Albert Bandura (1994) suggests that people with high self-efficacy—those who believe they can perform well—are more likely to tackle difficult tasks than avoid them.

Pupils with successful experiences often have a strong sense of fulfilment, and these experiences in turn boost their self-efficacy. Such pupils may blame themselves for not putting in enough effort if they fall short of their personal goals.

In contrast, pupils with low self-efficacy often attribute their failure to a lack of ability. Such experiences of failure are detrimental to their self-efficacy.

The Case of John and Diana

Let's try to understand John and Diana as biliteracy learners through the lenses of self-efficacy and SRL.

John
John needs to realize that the two languages share many similarities and his stronger oracy skills in English can help him achieve better reading fluency and, to a great extent, comprehension. However, if he stops at this level of achievement (i.e., reading fluency), his English writing will suffer.

Diana
Diana appears to be a beneficiary in terms of how she uses her stronger command of Chinese to facilitate her learning of English. To a large extent, she is a self-regulated learner with a sense of self-efficacy that is reinforced by her teachers' positive reprisals.

What is self-regulated learning?
SRL includes metacognition (thinking about one's thinking), strategic action (planning, monitoring and evaluating personal progress against a benchmark), and motivation to learn (Zimmerman, 2001).

Self-regulated learners are often aware of their strengths and weaknesses, and they usually have a repertoire of strategies for completing learning tasks. Successful learners proactively chart their learning through the use of SRL behaviours. They also exhibit a high sense of self-efficacy.

Research has found that good bilingual and biliteracy learners deliberately make use of learning strategies to achieve optimal results in a learning task.

What Can Teachers Do?

By providing more explicit scaffolding, teachers can help pupils make connections between the two languages. The following are some strategies teachers can use to facilitate biliteracy learning.

Set attainable goals. This allows pupils to experience success and gain confidence. When pupils feel that they are actually able to complete the learning task, they will become more interested in the subject and their self-efficacy will increase.

Share beliefs, goals and expectations. Before starting a task, such sharing can include some of the effective ways for achieving the desired goals and expectations.

Activate prior knowledge and experience. This can be done through experiential learning activities, applying knowledge in broader contexts, and integrating real-life examples with classroom-based learning.

Provide positive corrective feedback. Such feedback will provide pupils with guidance and affirmation to help them make their best effort to achieve better results. This will help pupils develop skills for SRL.

Engage in reflective conversations. These conversations help pupils consolidate what they have learned. Teachers can start doing so through talk-aloud/think-aloud and brainstorming in groups, which can allow pupils to discover their weaknesses and strengths.

This use of strategies-based instruction can strengthen pupils' learning capacity and help them make the transition from passive to active learners (Cohen & Macaro, 2006). Careful use of these strategies can help the Johns in your class enjoy learning both languages.

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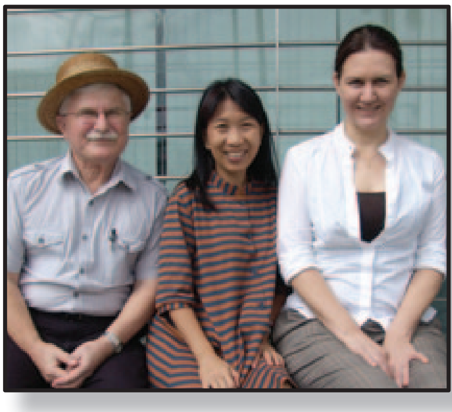
MathED

Strong Links Between Self-Confidence and Math Performance

Many studies have shown that there is a strong relationship between students' self-belief and their academic performance. How can this understanding help us in the Math classroom?

Article highlights

- What is the relationship between self-belief and math performance?
- What role does self-confidence play in learning math?
- Why is self-confidence important for math learning?



If students strongly endorse an incorrect answer to a question, then this indicates that something has gone wrong either in the learning or teaching process.

- Lazar Stankov,
Centre for Research in Pedagogy and Practice

Lazar Stankov is the Principal Investigator for the research project on "Confidence and Self-monitoring Among Singaporean Children". Together with **Suzanne Morony** and **Lee Yim Ping**, they examine the importance of non-cognitive skills and dispositions on academic performance.

An NIE study conducted by Professor Lazar Stankov, Dr Suzanne Morony and Dr Lee Yim Ping investigates self-beliefs and metacognition in mathematics students. They found that students who think they are good in math tend to perform well in math tests. What sets these students apart?

More About Self-belief

Lazar and his team suggest that students' beliefs in their own ability are of particular importance to their math performance. He identifies four kinds of self-belief:

- **Self-concept** refers to a student's belief in his ability in a particular subject. *E.g., "I have always believed that Math is one of my best subjects."*
- **Anxiety** is the apprehension a student experiences when learning math. *E.g., "I get very nervous doing math problems."*
- **Self-efficacy** is the belief that he is capable of producing some future outcome. *E.g., "Even if the work in math is hard, I can learn it."*
- **Self-confidence** has to do with how sure the student is about his abilities. *E.g., "I am confident that I have solved the math problem correctly."*

"There is plenty of evidence indicating that the first three of these self-beliefs are among the best predictors of how well a child does in school," says Lazar. "Few studies, however, investigate the role of confidence."

Exploring Self-confidence in Math

Findings from the study show that our students are conscious of what they are capable of and can determine quite accurately what they know and what they do not know—perhaps better than students in many other countries.

Collecting data from more than 600 Secondary 3 students in 5 schools, this is the first project in Singapore that focuses on measuring self-confidence.

"From this study, we know that confidence is a much better predictor of students' achievements than any other non-cognitive measure," notes Lazar. "In fact, it acts in a way that it overcomes everything else; so confidence is very important."

"We measure students' self-confidence by asking them to do a math test. After each item in the test, we ask how confident they are that their answers are correct," he explains.

Using this method, Lazar and his team calculate the students' confidence rating. It is then compared to their percentage of correct answers. The difference between students' confidence rating and percentage of accurate answers yields a bias score, which indicates how aware students are with regard to their math abilities.

Assessment for Math Learning

Lazar believes these confidence tests would benefit both learning and teaching. "If students strongly endorse an incorrect answer to a question, then this indicates that something has gone wrong either in the learning or teaching process." This has important implications in the area of assessment for learning.

The scores from the self-confidence tests provide students with insights into the topics they are weak in. Students who *think* they have given a correct answer to a question but are proven otherwise may gain the necessary knowledge of the kind of math topics they are weak in.

This could encourage self-reflection in students and motivate them to pay more attention to these weaker topics. "It teaches students to really think about what type of math questions they struggle with and which questions they thought were easy," says Suzanne.

For teachers, this information could guide them in effectively modifying instructions to cater to students' learning needs. "This could suggest to the teachers to explore alternative approaches to help the student access that particular knowledge, and to the students to devote more study time to this topic," observes Lazar.

Enhancing Learning

"When we went to share the findings with the schools, teachers were very interested to know their students' bias scores. They wanted to know how correct their students' answers were and how confident the students were about their responses being correct," says Yim Ping.

Some of the findings enabled to the teachers to sharpen their selection of specific strategies to increase their students' confidence. "They realized they could leverage on certain topics to explore enhancing students' self-confidence and interest," she adds.

By understanding the link between confidence and students' academic performance, we can better build on the firm foundation we have in math learning, to make our competent learners also confident learners.

Lesson Study in Action

Our learning journey never ceases. This is true for teachers as much as it is for their pupils. Research has shown that teachers become more effective in their teaching practices when they learn and inquire together. What can we do to encourage such learning among teachers?

The effective teacher is one who is committed to constantly improving on and developing his or her teaching practices. This process is enhanced when there are opportunities to collaborate with like-minded counterparts and also to observe and reflect.

Responding to this, the Ministry of Education (MOE) has encouraged the concept of the *professional learning community* (PLC). The PLC embraces the idea of getting teachers to work together in teams to enhance their effectiveness as professionals so as to benefit students' learning.

Lesson study is one way of engaging teachers in such learning. It is one of several vehicles used in PLCs, and its popularity in Singapore is growing.

Lesson study is a professional development process devoted to instructional improvement. Working collaboratively to plan a lesson, teachers get to deliver a live "research lesson", observe the way lessons are being carried out, and reflect on these lessons to improve their teaching practices.

Local Experience with Lesson Study

Over the last 2 years, North Vista Primary School (NVTPS) has made use of the lesson study approach as a way to develop their teachers professionally. And in August last year, they organized Singapore's largest lesson study public research lesson.

Led by Mrs Irene Ong, Head of the Mathematics Department, and former School Staff Developer Ms Peggy Foo, a team of Math teachers was formed to fully experience the lesson study process. Their main objective was to find out whether pupils were able to reason and communicate mathematical thinking.

"We wanted to see what kinds of tasks and activities help our pupils reason and communicate mathematical reasoning more effectively," explained Irene. "Besides just focusing on math, we also tried to incorporate technology into the lesson with the use of the interactive whiteboard and 1:1 computing."

What was unique about the NVTPS experience was that the research lesson was made public—over 250 educators from Singapore and overseas, MOE curriculum specialists and university professors were present to observe the lesson.

Peggy, who is currently an Adjunct Lecturer with Marshall Cavendish Institute, noted: "It was the first time any school in Singapore had conducted a research lesson on such a large scale."

The Lesson Study Process

Lesson planning
Irene shared that they started the process by first developing a detailed lesson plan. "As effective questioning was part of the process, we had to think about the kind of questions we wanted to ask the pupils," said Irene.

Article highlights

- What is lesson study?
- How has lesson study been implemented in a Singapore school?
- How can teachers benefit from lesson study?

The objective of lesson study is for teachers to grow professionally.

- Irene Ong,
North Vista Primary School

Peggy added that much was learned when the team was considering various possible responses from pupils of different ability groups. "More importantly, we have to think about how we could respond to them—to those who have already mastered the concepts and to others who have not fully grasped the basic concepts."

Lesson observation

After a detailed lesson plan has been developed, a teacher will then teach the lesson with the other team members as observers. This particular lesson was conducted by Irene in the school hall. The mass audience of educators participated as observers, watching the lesson as it progressed on stage.

The pupils' discussions and work were also projected on the walls, to give the observers a window into the pupils' reasoning and thinking process. This helped the teachers to develop an "eye" to understand pupils' thinking and consider follow-up instructions to support their learning.

Both Irene and Peggy agreed that this was particularly useful as they were able to surface misconceptions the pupils had. Irene added that this process should be non-judgmental, and observers should note that they are there to draw out learning points from observing the lesson.

Post-lesson discussion

The team members, together with the observers, engaged in a discussion straight after the live lesson. This was facilitated by Dr Makoto Yoshida and Dr Yeap Ban Har, who are leading researchers and educators in the field of lesson study. The immediacy of this discussion ensured that the details of the lesson were still fresh in the teachers' minds.

One of the key factors to note for lesson study is to be extremely clear of its purpose. "As we had a large audience, they needed to know exactly what they were observing. The learning was also exceptionally rich as we were able to hear diverse perspectives from different observers," shared Peggy.

A Rewarding Experience

Irene advocates lesson study as a professional development tool as she believes that engaging in the whole lesson study process is extremely beneficial for teachers.

Lesson study goes far beyond simply planning a lesson. After the post-lesson discussion, the team of teachers would go back to the lesson plans to refine them, and the whole process would be repeated again. It challenges teachers to improve on their classroom instruction as the group refines the original lesson, hence enabling them to design better lessons in future.

"The objective of lesson study is for teachers to grow professionally," noted Irene. "One of the key features of lesson study is looking deeper into the children's responses and developing effective strategies through that."

Lesson study merges research and practice in the most practical of ways. This approach is rich in the possibilities for teachers' professional and personal development, where teachers can continue to be active and engaged learners throughout their teaching career.

Acknowledgement

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