Educational Practices Series

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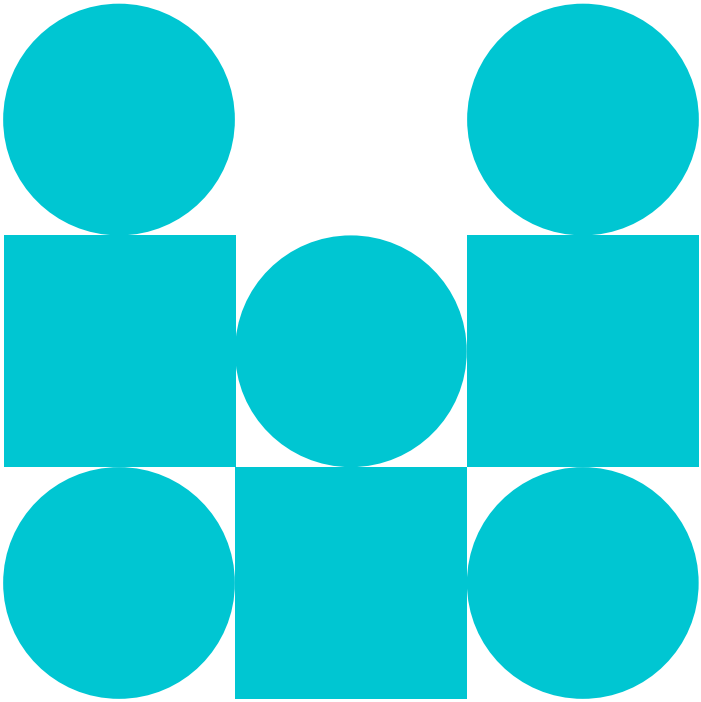
Teaching students how to learn: Setting the stage for lifelong learning

by Stella Vosniadou, Michael J. Lawson, Helen Stephenson, and Erin Bodner



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The Series was started in 2002, as a joint venture between the International Academy of Education (IAE) and the International Bureau of Education (IBE). So far 30 booklets have been published in English and many of them have been translated in several other languages. The success of the Series shows that the booklets meet a need for practically relevant research-based information in education.

The series is also a result of the IBE's efforts to establish a global partnership that recognizes the role of knowledge brokerage as a key mechanism for improving the substantive access of policymakers and diverse practitioners to cutting-edge knowledge. Increased access to relevant knowledge can also inform education practitioners, policymakers and governments how this knowledge can help address urgent international concerns, including but not limited to curriculum, teaching, learning, assessment, migration, conflict, employment and equitable development.

Governments need to ensure that their education systems meet their core and indisputable mandate, which is to promote learning and, ultimately, to produce effective lifelong learners. With the aggressive pace of contextual change in 21st century, lifelong learning is a critical source of adaptability, agility to adapt, and the resilience required to meet challenges and opportunities. Yet, for many countries around the world, effective facilitation of learning remains a daunting challenge. Learning outcomes remain poor and inequitable. Intolerably high proportions of learners fail to acquire prerequisite competences for lifelong learning such as sustainable literacy, digital literacy, critical thinking, communication, problem solving, as well as competences for employability and for life. Systems' failure to facilitate learning co-exists with impressive advancements in education research, driven by research from diverse fields, including the sciences of learning, particularly the neuroscience of learning, and advancements in technology.

The IBE's knowledge brokerage initiative seeks to close the gap between scientific knowledge on learning and its application in education policies and practice. It is driven by the conviction that a deeper understanding of learning should improve teaching, learning, assessment, and policies on lifelong learning. To effectively envision and guide required improvements, policymakers and practitioners must be fully cognizant of the momentous dialogue with research.

The IBE recognizes the advancements already made, but also that there is still much more work to be done. This can only be achieved through solid partnerships and a collaborative commitment to building on previous lessons learned and continued knowledge sharing.

The Educational Practices booklets are illustrative of these ongoing efforts, by both the International Academy of Education and the International Bureau of Education, to inform education policymakers and practitioners on the latest research, so they can better make decisions and interventions related to curriculum development, teaching, learning and assessment.

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Introduction

In the last years, educators and policymakers have put a great deal of emphasis on the need to develop an education for the twenty-first century—an education that prepares our students to meet the economic, technological, and societal needs of our knowledge-based economies. There is wide agreement that the main characteristic of life and work in the twenty-first century is its changing nature. Changes are happening so fast that it is hard to predict the exact jobs the students of today will have over their lifespan. This creates a need to equip students with the capabilities of independent and lifelong learning; in other words, to teach them how to learn. Despite the broad recognition of this important shift in education goals, we still know little about how to teach students how to learn, and especially what this shift means about the way teachers teach in their classrooms. The need to develop students' capabilities for independent learning has become even more urgent today as we emerge from the Covid-19 pandemic, which has seen unprecedented school closures and dramatic increases in independent online learning.

The purpose of this publication is to provide basic information to teachers about how to help students become independent learners. Its recommendations are based on the conceptual framework known as 'self-regulated learning', or SRL. Self-regulated learners have flexible knowledge and skills that enable them to manage their cognition, motivation, and emotions in the pursuit of their learning goals. They can work independently to construct complex knowledge and know how to monitor their comprehension and to persist with difficult problems. Although students can acquire many of the capabilities of a self-regulated learner on their own from their experiences in everyday learning situations, many students do not develop these capabilities adequately. On the contrary, the strategies they use to manage their learning are ineffective and inefficient and result in learning failures. It is estimated that one of the main reasons that about 30% of the students who start their studies at US universities decide to drop out after the first year is their unpreparedness to cope with the demand for independent learning and self-reliance.

In this Teaching How to Learn booklet, teachers can find information about some of the cognitive, metacognitive, emotional, and motivational capabilities that characterise self-regulated learners, and some of the actions that teachers can take to promote self-regulated learning in their students. These include giving students time to engage in constructive tasks independently or in collaboration with their peers and providing them with the knowledge and strategies that they can use to manage their learning and control their motivation and emotions while they complete these tasks successfully.

Our work in the 'Teaching How to Learn: Promoting Self-Regulated Learning in STEM classes' project—which is supported by a Discovery grant from the Australian Research Council, (www.teachinghowtolearn.edu.au)—is the basis of the above-mentioned recommendations. This project involves the design and evaluation of professional learning strategies intended to help teachers create learning environments that promote student engagement and independent learning, especially when teaching STEM (science, technology, engineering, and mathematics). The project is a collaboration between Flinders University and the University of Melbourne in Australia, and also with the Johann Wolfgang Goethe-University in Frankfurt, Germany, and the State University of Arizona in the USA.

We would like to thank our colleagues for their invaluable help and collaboration in this work: Penny Van Deur, Mirella Wyra, Robert Mason, and David Jeffries at the College of Education, Psychology and Social Work, Flinders University; and Lorraine Graham, Sean Kang, Emily White, Wendy Scott, and Carolyn Murdoch at the Graduate School of Education, the University of Melbourne. We would also like to acknowledge the contributions of Igusti Darmawan at the University of Adelaide, Jodi Gordon at the Australian School for Mathematics and Science (ASMS), and Lachlan McFarlane at Blackwood High School, as well as all the educators and preservice teachers who participated in our programs.

1.
Developing the capabilities necessary for lifelong learning is important for success in school and life in the twenty-first century

For students to cope with the continually changing knowledge and skills required by today's knowledge-based economies, schools need to pay more attention to the education of independent and self-directed learners.

What research shows

Education systems often place their emphasis on providing students with subject matter information—on teaching them what to learn rather than on how to learn. Although the development of a deep understanding of subject content is an important aspect of schooling, it is not sufficient for success in the knowledge-based societies of the twenty-first century (OECD, 2020). Schools also need to educate students to be independent and self-directed learners who can take responsibility for their own continuing, lifelong learning. As Bjork et al. (2013) aptly describe it: 'Our complex and rapidly changing world creates a need for self-initiated and self-managed learning. Knowing how to manage one's own learning activities has become, in short, an important survival tool' (p. 418).

People have written much about the importance of lifelong learning, but we still know little about how to promote it. The purpose of this booklet is to provide a summary of research and some recommendations for teachers who would like to learn how to help their students develop the skills of a lifelong learner.

A great deal of the research on learning how to learn is taking place under the conceptual framework known as 'self-regulated learning' (SRL). SRL approaches investigate how students can learn to manage their cognition, motivation, and emotions so that they can set and achieve their learning goals and make use of the support available from peers and teachers. Educational research has demonstrated the positive impact of instruction in self-regulated learning and has shown that such instruction can have a significant benefit for student achievement (Dunlosky, 2013; Greene, 2018; Zimmerman & Schunk, 2011).

Although students implicitly acquire many of the capabilities of self-regulated learners in their everyday settings, many have not developed their SRL toolkits adequately and could profit from explicit SRL instruction. Teachers can play an important role in helping students become self-regulated learners through the explicit promotion of SRL in the classroom. In principles 2 to 7 we will provide further detail about how you can do this. Below is a description of the five main types of SRL capabilities.

The capabilities of a self-regulated learner

Resource-management capabilities. Self-regulated learners know how to organise their environment in ways that help them learn. For example, they know that it is important to find a quiet place to study and to minimise other distractions, to make efficient use of their time, to have their books and notes organised, and to know how to access digital and other resources. They know when they need to seek help from their teachers, peers, or other adults and how to do so. They also have strategies that allow them to collaborate with others effectively.

Cognitive capabilities. Self-regulated learners have the knowledge about cognition and the cognitive strategies required to help them manage their cognition during learning. They can control their attention and focus on the task at hand; they know how to break a difficult task into smaller parts to make it more manageable. They know how to activate their prior knowledge and use it to learn new information. They have access to strategies that help them practise, elaborate, and organise new information and retrieve it from their memory. They can summarise the main points in the texts they are reading, they can understand interrelationships amongst concepts, they can draw inferences beyond what is explicitly stated, and they can transfer what they learn at school to relevant contexts outside of school.

Metacognitive capabilities. SMetacognition refers to learners' ability to reflect on what they know and on how they learn. Being aware of the self as a learner is also an important aspect of metacognition, necessary for students who would like to be able to control their cognition and motivation to improve their learning. Self-regulated learners know how to make effective plans for their learning and how to monitor their comprehension effectively—they know when they do not understand, and they have strategies that allow them to go back and repair their comprehension failures. They know how to evaluate their learning accurately and effectively.

Motivational capabilities. Self-regulated learners have confidence in themselves as learners—they believe that they are capable of

learning difficult material. They are intrinsically motivated to learn and have the perseverance needed to overcome failure and pursue long-term goals. They know how to motivate themselves to cope with challenging tasks and how to productively interpret both their successes and their failures in those tasks. They are aware of their academic weaknesses and have adaptive strategies in place to help them improve their learning and performance. For example, they tend to attribute their poor performance to lack of effort or lack of appropriate strategies rather than to lack of ability or to external factors beyond their control.

Emotional capabilities. Self-regulated learners are aware of their emotions and can control them. They feel proud when they achieve their learning goals, and they derive other positive feelings from learning as well. They are aware of their anxiety during exams and have strategies to manage it.

Suggested readings: Bjork, Dunlosky, & Kornell, 2013; Greene, 2018; OECD, 2020; Schunk & Zimmerman, 2013.

2.
Giving students time to engage in independent and collaborative learning in the classroom helps them acquire and practise their lifelong learning skills

Teachers can help students acquire the capabilities of self-regulated learners by engaging them in constructive and interactive tasks and by helping them to complete those tasks successfully.

What research shows

In many classrooms, teachers control most aspects of the learning process. However, for students to engage in independent or collaborative learning, they need time and opportunities to acquire, use, and further develop the SRL capabilities described in Principle 1. For this to happen, teachers must make provision in lessons for students to have some time for such learning. Teachers' beliefs that their main task is to provide students with subject-matter knowledge sometimes prevent them from finding the time in their lessons to give their students some agency over their learning (Vosniadou et al., 2020).

Giving students autonomy and opportunities for independent and collaborative learning does not mean that teachers should simply let students learn on their own. To support their efforts to promote self-regulated learning and to maximise their students' cognitive engagement, educators ought to consider both the nature of the learning tasks they give to their students and the instructions they provide when introducing these tasks.

The ICAP theory, introduced by Chi and Wiley (2014), is a helpful framework for evaluating the levels of student cognitive engagement that different kinds of tasks involve. ICAP stands for interactive, constructive, active, and passive cognitive engagement. Students are engaged in the passive mode when they receive information from instructional materials without doing anything observable related to learning; an example is listening to a lecture. Active engagement is characterised by some form of overt action, as happens, for example, when students are listening to a lecture and also taking notes. Constructive engagement occurs when students are occupied in tasks likely to generate new knowledge or to link information to prior knowledge. Examples of such constructive tasks are asking students to explain a passage, ask critical questions, generate new inferences, transfer academic information to everyday life, or evaluate their learning. Interactive tasks are constructive tasks that also require interaction with at least one other partner, usually a peer.

Research shows that constructive and interactive modes of engagement result in better learning outcomes than passive and active modes. Interactive tasks are particularly encouraged because, when interacting with others in the context of a constructive task, participants can benefit from the questions, suggestions, elaborations, and perspectives of their collaborators—resulting in the co-construction of new knowledge that would not have been possible without the interaction.

What teachers can do

Include constructive or interactive tasks in your lesson. As an example, you might ask your students to create a concept map that organises the information they have been working on during the lesson, to compare two graphs that present similar information, to find similarities and differences in two accounts of the same process, or to explain a difficult concept to themselves or their peers. Students could do this independently and/or in a group, where they will also have to justify their solutions.

Pay attention to the exact words that you use when you instruct students to do a task. Consider the directions that you use for lesson tasks. Tasks that direct students to repeat or recall, to identify or highlight will require students to be active but do not require further generation of information. Constructive tasks that use verbs such as discuss, debate, compare, explain, and justify will require the students to process the lesson information in ways that can stimulate higher levels of understanding.

Use modelling to demonstrate how you would like the students to engage in a constructive task. Take the opportunities in lessons to show students what you consider to be a good technique for handling a problem, lead them through what you regard as an appropriate explanation as opposed to an inadequate one, or model for them a persuasive argument in favour of a position that needs to be defended. These opportunities for explicit modelling of your thinking arise quite frequently and provide students with powerful models of self-regulation of learning.

Provide opportunities for interactive engagement when the students are engaged in a constructive task. Try to ensure that any group or collaborative activity does not limit the possibilities for students to generate understandings beyond those that they held before they interacted with their peers. A simple request to students to explain or justify their solutions or their conclusions can stimulate valuable interactive engagement. Likewise, a requirement to report back to the class on their understanding of the task can enable other students to consider and critique suggested solutions.

Suggested readings: Chi & Wylie, 2014; Chi, Adams, Bogusch, Bruchok, Kang, Lancaster, Levy, Li, McEldoon, Stump, Wylie, Xu, & Yaghmouriank, 2018; Lawson, Vosniadou, Van Deur, Wyra, & Jeffries, 2018; Menekse & Chi, 2018; Vosniadou, Lawson, Van Deur, Wyra, & Jeffries, 2020; Vosniadou, Igusti, Lawson, Van Deur, Jeffries, & Wyra, 2021.

3.
Students can learn how to manage their cognition better when they know about how learning happens in the brain and about how to encode and organise information in memory

Students may well have incomplete or erroneous knowledge about how learning takes place and often use inefficient learning strategies. Teachers can play an important role in helping their students achieve a better understanding of how they can improve their learning.

What research shows

Students' knowledge and beliefs about learning are often incomplete or inaccurate and do not provide them with an adequate basis on which they should plan and manage their learning. For example, some students believe that learning is a natural process and therefore that it cannot be taught. In other words, they think that you are either born a good learner or not. Others think that when we learn we make a copy of the new information and store it in memory, in a sort of mental filing cabinet. To help students move beyond such understandings, teachers can promote SRL in the classroom: they can help their students to realize that one can develop and improve learning skills—and that they can become better learners if they know how the brain processes information and how to use strategies that facilitate this processing.

Recent neuroscience research provides useful guidance for how we should conceptualise learning. Learning and problem solving are complex, involving many areas of the brain; the interactions between these areas that occur during learning provide the basis for our organisation of knowledge. Unlike tape recorders, which record information verbatim, our brains interpret incoming information in more or less detailed ways to construct meaning. This means that even when students make minimal efforts during learning they are still interpreting, and very likely changing, information presented by a teacher or a text. Researchers have identified many strategies for doing this interpretation that can help learners extract meaning as accurately as possible and store it in memory. Many other strategies

can help learners acquire new knowledge in domain-specific areas, such as strategies for playing chess, improving text comprehension, writing essays, or solving algebra problems. The teacher will know and use both of these types of strategies—the general and the specific—and can use them as the focus of modelling activity in lessons.

Students often use relatively ineffective study strategies, such as "cramming" the night before an exam, instead of strategies that research has shown are more effective. For example, studies have found that practice testing, in which students are provided with sample questions or previous exam questions, can improve learning and test performance (Bjork et al., 2013). The emphasis here for teachers should be on explicitly promoting effective learning and study strategies during lessons so that students can practise them in class and thus be more able to use them independently during the study times when they are directing their own learning.

What teachers can do

Design a course on learning for the students in your school. An option that some schools use is to provide a course on learning and learning strategies for their students. The logic of this is that such a course can help your students directly develop their knowledge about learning, knowledge that they need in every lesson and study period. In this way, you help your students become more independent in their learning because they understand better how learning happens and how they can develop appropriate strategies to manage it. Remember that it is the students who are ultimately responsible for their learning, even when engaged in direct instruction in a lesson.

Talk to your students about learning at appropriate times during your lesson. It is clear that students can be active users of their knowledge about learning and its management whenever they are in lessons. It will thus be helpful for you, at appropriate points in a lesson, to talk in some detail about the nature of learning. As noted earlier, opportunities for such talk occur frequently in lessons, where your modelling of strategies can add to your students' knowledge about learning and problem solving. This might also occur, for example, when you are talking to students about their exams; you could provide information about how they could arrange their study environment, organise a schedule for completing all questions on an exam, or handle their anxiety.

Ask your students to explain how they learn: 'How did you do that?' Another broad approach that is easy to use but often very

rewarding is to simply ask your students to tell the class how they solved a problem, or how they got part of a correct answer. You will know students who have good general learning strategies and/or effective task-specific strategies. In a lesson when you think other students can benefit from a description of strategies, ask some of these effective learners to take over the explicit promotion of a useful strategy.

Suggested readings: Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Usher & Schunk, 2018; Vosniadou, 2001.

4.

A key to success in learning how to learn is the acquisition of a large repertoire of explicit strategies and knowledge about how to use them effectively

When strategies are taught in an explicit way with information about why, when, and how it is best to use them, they help students become better learners and problem solvers.

What research shows

A large part of our knowledge consists of strategies about how to do things. This applies to all domains of knowledge, from learning mathematical operations, to learning how to conduct science experiments, to learning how to comprehend or write a text, to learning how to cook, or to learning itself—i.e., learning how to learn. We now recognise that a key part of teaching involves the teaching of strategies. Research has shown that students who have a large repertoire of strategies and know how to use them effectively in different learning situations have better learning outcomes than those without such a repertoire (Dignath & Büttner, 2008; Hattie, 2013).

It is useful to make a distinction between domain-specific learning strategies, and domain-general learning strategies. The former helps us learn in specific subject-areas, like math, art, or reading comprehension. A great deal of teaching mathematics, for example, concerns the teaching of procedures or strategies about how to manipulate numbers and solve problems. Domain-general learning strategies, on the other hand, help us learn in most subject-matter areas. These include not only such strategies as spaced practice, self-questioning, and test-taking but also such cognitive and metacognitive strategies as the activation of prior knowledge, self-explanation, and comprehension monitoring, as well as strategies for the management of motivation and emotion.

Although teachers teach strategies all the time, they usually do so implicitly, in the context of a lesson, without making it clear to the students that they are simultaneously teaching them a learning strategy. When a strategy is taught in an implicit way, the strategy might help the student to accomplish the task at hand, but the student is not alerted to the fact that the teacher has used a specific strategy. This makes it unlikely that the student will be cued to transfer the strategy to other situations where its use might be appropriate.

Explicit strategy instruction happens when the teacher describes a strategy by using the word 'strategy' or providing a name for the strategy and describing it in detail. To be considered explicit strategy instruction, the teacher's intention to instruct a strategy must be clear, so that the students understand that they could use this strategy in this as well as in other lessons. When instructors teach strategies in an explicit way—with information about why, when, and how it is best to use them—they add to the repertoire of strategies that students can use in new situations, thus helping them become better learners and problem solvers.

What teachers can do

Think about the kinds of learning strategies your students need to know, and teach these strategies explicitly. Use the word 'strategy' or provide a name for the strategy because this helps students to attend to the details of the strategy, remember it, and so be more likely to use it in other situations in the future. Compare the two examples below, which demonstrate how a strategy can be taught in an implicit or an explicit manner.

Implicit strategy instruction: 'When reading for meaning in reading-comprehension activities, it helps to think about what you already know about the topic of the passage.'

Explicit strategy instruction: 'When you use the "Activate your prior knowledge" strategy, you are getting ready to check what it is that you already know that might be related to the information in the passage you are reading. If you activate your prior knowledge, you can then better decide whether what you are reading "fits" with what you already know, and this prompts you to think critically about the new information and remember it. This is a strategy you can use in many tasks in this subject and in other subjects.'

We draw attention to two features of this example. First, the strategy that the teacher focuses on is well known. You might think that this would mean that it is not important for a teacher to draw explicit attention to it in a lesson. However, as we have noted above, many students do not automatically use many well-known strategies or do not use them as often as they should. So, these students are helped by the strategy information from the teacher.

Second, the additional information provided in the explicit strategy promotion provides the student with an explanation for why the strategy will be useful, and also cues the student to think of using the strategy for other lessons.

Suggested readings: Dignath & Büttner, 2008; Hattie, 2012.

5.
It is important to provide students the time and support needed to reflect about their knowledge and teach them how to plan, monitor, and evaluate their learning

The development of students' metacognitive capabilities is one of the most important aspects of the promotion of SRL in the classroom. The use of metacognitive strategies during learning is a strong predictor of student academic performance.

What research shows

The term 'metacognition' refers to the knowledge we have about our own cognition and how we can manage cognitive activity. Put less formally, metacognition refers to the knowledge one has about one's own thinking and learning, and about strategies to regulate this learning. As mentioned in Principle 4, students may have implicit knowledge about learning and about learning strategies. However, this implicit knowledge is more helpful when it becomes explicit and can be discussed—in that way, it falls more effectively under the learner's metacognitive control. Thus, I might have a particular view of my reading comprehension capability, but my ability to profit from my study increases when I have a repertoire of explicit strategies that I can use to comprehend text, and know—and can explain—when and how it would be good to use them. The amount and quality of learning depend critically on such student metacognitive activity, i.e., on how students engage with instructional materials, on their success in monitoring their comprehension while they study, and on the strategies they employ to repair their comprehension failures (Chi & Wiley, 2014; Dignath & Büttner, 2008; Hattie, 2013).

A long history of research on reading comprehension shows that many students who find text comprehension difficult do not have well-developed strategies to use for this task. However, students can improve their level of comprehension when they learn to use strategies, such as concept mapping or self-explanations of key sections, and this is reflected in improved performance. Similarly, they can increase their ability to monitor their comprehension, such as looking for links in the text or inconsistencies, and instruction in these skills is associated with improved comprehension.

Research on self-regulated learning identifies three major metacognitive processes: planning, monitoring, and evaluating (Schraw, 1998). Planning refers to activities such as analysing the task at hand, setting goals for how to accomplish it, and planning how to achieve these goals. Monitoring refers to the continuous process of assessing whether the selected learning strategies are relevant to making progress toward a set goal and whether such progress is being achieved. Evaluation refers to the reflection that takes place when the task is completed and could involve thinking about the ways in which the task was accomplished, or about possible needed modifications in approach. Hence, in being metacognitive about my mathematics task, I could draw up a plan for how to solve a problem, check on my progress as I proceed with the task, and also look back over my performance on this task to see if I have achieved the desired result or if I should have done anything differently.

What teachers can do

Talk about metacognition and its components and give time to students to reflect. One key task is to talk with your students about the different components of metacognition using the appropriate technical vocabulary so that they can develop their knowledge about what metacognition is, why it is important, and how to achieve it. It is also important to give students the time and support they need to adequately reflect on what they know so that they can better organise and solidify their knowledge in memory and understand what they do not yet understand and need to learn.

Model metacognitive activity for students. It is very likely that you will find regular opportunities in lessons to identify gaps in your students' metacognitive knowledge and strategies. In these situations, it will be advantageous to draw explicit attention to examples of metacognitive activity by modelling it for students. For example, if comprehension monitoring is an issue for your students, you could model useful comprehension-monitoring strategies during a lesson, like checking on meaning, re-reading sections of the text, self-explaining parts of the text, or using a mapping diagram to show connections between sections of the text's argument.

Ask students to model their metacognitive activity. Likewise, opportunities for explicit discussion of metacognition will arise when you ask your students to reflect on how they have undertaken an activity or solved a problem. In these instances, other students

get another opportunity to hear and see useful metacognitive strategies in action.

Focus on planning, monitoring, and evaluation during lessons. You can design a further, more direct approach to use of metacognitive skills into a lesson when you ask students to pause and use planning, monitoring, or evaluation skills. For example, you could present a problem and then set aside time for students to generate a plan for working on it. Similarly, after students have begun work on a problem, you could ask them to report on their progress: 'How are you going with this problem?'.

Teach students a set of questions they can ask themselves to help them plan, monitor, and evaluate their learning. You can provide students with a set of metacognitive questions that can help them self-regulate during learning. For example, students can check their planning by asking questions such as:

- What kind of problem is this?
- Have I seen similar problems before?
- Do I need to have more information before I am able to solve this problem?
- What is my plan of action for solving this problem?

For example, students can check their planning by asking questions such as:

- Am I sure about what I am doing?
- What are the things I do not understand?
- How well are my strategies working?
- Do I need to try a different approach?

To evaluate their learning, students can be taught to ask themselves:

- Have I mastered the information I set out to learn?
- What are the most important points?
- What are the strategies that I used?
- What are the strategies that worked well that I should remember for next time?
- What do I need to do differently next time?

Prompt metacognitive activity during lessons. During lessons, you can provide simple reminders to students—either individually or in a group—to monitor their comprehension or to use relevant strategies they already know. For example, you may have taught your students some useful strategies in prior lessons. To prompt them to remember to use such strategies, you could say something like:

- Before you work on this problem, think about the different strategies we have discussed about how to deal with math anxiety.
- Before you start on this, remember to set up your plan.
- As you work on this text in your group, remember to share your interpretations with others in the group.

Prompt students to use their knowledge about learning. Sometimes your students may feel 'stuck' in their learning and forget that they have previously discussed in class what might be done in those scenarios. In such situations, you can prompt students to use their knowledge about learning. The prompts can be short reminders likely embedded in questions to the students:

- How is it going?
- If this approach isn't working, can you think of another way to look at the problem?

These situations can also be good times to get some input from other students:

- Okay, let's just pause here for a moment. I'd like you to share with us how you have been working on this problem, so we can think about it together.

Prompt students to use their knowledge about learning. Like many teachers, you may already use evaluative activity at the end of lessons, such as 'exit cards', in which you ask your students to provide written or oral feedback on their progress with the task at hand. For example, you might say:

- Is there anything you don't understand about this or that you want more information on?
- Rate your level of understanding of this topic.

Remember to use this feedback to inform your planning of the next lesson.

Suggested readings: Chi, Bassok, Lewis, Reimann, & Glaser, 1989; Dignath & Büttner, 2008; Hattie, 2013; Schraw, 1998; Winne, 2018; Zepeda, Hlutkowsky, Partika, & Nokes-Malach, 2019.

6.
Students must be motivated to use their knowledge and strategies if knowledge about learning is to be beneficial

Motivation determines the choices that students make when they study and the quantity and quality of the effort they invest in their learning.

What research shows

Teaching students about learning and the approaches to effectively monitor it will not be of much help if the students are not motivated to use their knowledge and strategies. Motivation provides the impetus or 'will' for students to act and behave to achieve their desired goals. It determines the levels of effort, persistence, and strategy use that they invest in their learning. More effective self-regulation of motivational states can help students achieve better learning outcomes. However, we need to recognise that motivation is also shaped and influenced by students' opinions, values, and judgements of learning situations, or by their motivational beliefs. So, teachers might usefully address such beliefs when appropriate.

Some motivational beliefs concern beliefs about the control we have over our own learning. If students believe that learning is something innate that they cannot control, they will have little motivation to invest effort in understanding how learning happens or about strategies that can improve their learning. Other motivational beliefs refer to opinions that students have about their own ability to learn in a specific domain—e.g., 'I am not good at math'—often referred to as 'self-efficacy' beliefs. Another set of important motivational beliefs have to do with attributions of success or failure. Some students attribute failure to internal factors that cannot be changed, such as lack of ability, rather than factors they can control, such as their lack of effort or failure to use appropriate learning strategies (Boekaerts, 2002).

Students' learning experiences, and the actions and talk of teachers, parents, and peers, all influence motivational beliefs. Teachers can help students to become aware of their motivational beliefs and to learn efficient strategies to manage them.

Current research on knowledge about SRL and its promotion shows that a motivational element exists not only for students but also for teachers regarding the further development of student knowledge about SRL. Research such as that of Nibali (2017) indicates that while teachers see knowledge about SRL as important, many do not think they have time to make it part of their lessons. This stance seems to be attributed to beliefs that the self-regulation of learning is not something that needs to be taught explicitly and/or it is not really important for student achievement, despite strong research evidence to the opposite (Dignath & Buttner, 2008; Lawson et al., 2018).

What teachers can do

Try to understand the motivational beliefs of your students. Knowing your students' motivational beliefs will assist you in planning learning activities that help students capitalise on their favourable beliefs and question their unfavourable ones. During lessons, you could directly point out to students the achievement benefits of improved SRL knowledge and its use. This can be done when you are modelling new SRL strategies.

Encourage students to see that they can have control over their successes and failures. Help your students move away from interpreting success and failure as linked to their innate ability or to external factors, such as the difficulty of the tasks, the conduciveness of learning environments, or the influence of other students or their teachers. Encourage them to see that success and failure can also be attributed to factors under their control, such as the effort they put in their study or the effectiveness of their strategy use.

Scaffold students' initial use of new strategies. For students who do not have mastery of a strategy appropriate for a given task, it is important to provide some scaffolding of the initial use of the strategy. Slowing the pace, providing point notes, developing wall charts showing steps in a strategy, and encouraging initial attempts can have strong impacts on your students' motivational levels. Suitable students who have already mastered use of the strategy can provide scaffolding as well, and doing so will likewise strengthen those students' knowledge of the strategy.

Help students understand the links between their learning actions and the outcome of their actions. The strategies your students use (or do not use) can determine their success (or difficulty) in learning tasks. Provide feedback that helps students learn how and why strategies work. Stimulate them to reflect on their own performance and recognise that they have been building their repertoire of strategies

for learning. A boost in students' levels of self-efficacy can encourage them to persist more and to give themselves the chance to complete difficult tasks that they thought they could not do.

Show students how their interest and the value they place on tasks are motivating factors that can impact learning outcomes. Use meaningful tasks in your teaching and explain their value to students both for their learning and for their relevance to life outside school. Ask their motivated peers to discuss the value and relevance they find in learning new skills. You can marshal individual interest by giving students some freedom to shape topics that are of interest to them and to explain why they find these tasks interesting, relevant, easy or difficult, and important. Some teachers also involve their students in decisions about topics to be studied, so that the learning in these topics is felt as a cooperative venture directly involving the teacher and students as a team.

Suggested readings: Boekaerts, 2002; Nibali, 2017; Yeager & Dweck, 2012; Lawson et al., 2018; Dignath & Buttner, 2008

7.

The regulation of negative emotions is an important aspect of becoming a lifelong learner

Negative emotions are often the cause of students' failure to live up to their potential and pursue their abilities and interests later in life.

What research shows

Students' emotions can have profound influences on their learning and achievement and on choices they make about themselves later in life (Coleman, 1966). Positive emotions, such as the enjoyment of learning, can increase student motivation, interest, and attention. However, negative emotions, such as shame, anger, and especially anxiety, can be particularly debilitating (Pekrun, 2014). They cause students' attention to drift from the task, making them preoccupied with their thoughts and worries instead of with the material to be learned, leading to poor performance. A type of anxiety often experienced in school settings is math anxiety, i.e., a feeling of tension and fear regarding situations that involve processing numbers and solving mathematical problems. Research shows that the higher the math anxiety of students, the lower their math performance. High-ability, as well as struggling students can experience academic anxieties, and it is often the cause of students' not pursuing ambitious career paths later in life (Carey et al., 2019; Szucs & Mammarella, 2020).

Students' academic self-confidence greatly influences their emotions. Students who feel confident are likely to enjoy learning and be proud of their accomplishments. On the contrary, lack of self-confidence increases anxiety and shame related to failure. Anxiety and shame are usually associated with damaging thought patterns—for example, students may think that their parents will react negatively to their bad performance on exams or that their peers will make fun of them. Such thoughts occupy space in working memory, leaving less room for processing the task at hand, with a negative impact on performance and further loss of self-confidence. It is important to help students break this destructive cycle by understanding the connection between their damaging thought patterns and their academic performance, and to help them learn how to regulate their negative emotions.

What teachers can do

Build and maintain good relationships with your students, with a foundation of trust and respect, and be sensitive to the emotions they are experiencing. Emotional reactions can differ widely amongst individual students, across different cultures, and across school subjects. Students may regard their emotions as a private affair not to be shared with others. They will be more likely to disclose their emotions if they feel that they can trust you.

Help students become aware of the emotions they are experiencing, especially anxiety over performance in academic settings and mathematics. Give your students the opportunity to talk about their emotions and thoughts associated with academics and exams. Ask them to talk about their emotions in small groups or to reflect privately on them. Becoming aware of their emotions is the first step for students to find appropriate ways to manage them.

Explain to your students the relationship between thoughts, emotions, and behaviour. Discuss with your students how negative thoughts can lead to anxiety and how anxiety can decrease attention and self-confidence, leading to poor academic performance. Discussion about the limitations of working memory and the role of practice in reducing stress and distractions can help students understand more about the relationship between their emotions and how they affect their cognitive processes.

Help your students control their emotions by replacing negative with positive or useful thoughts. An example of a positive thought is, 'I am anxious about the test, but I have studied hard this time and I know I can succeed.' Ask the students to find their own positive thoughts to replace their negative ones and write them down. Having clear plans for working on a task can also be reassuring because it helps students see that they have ways of moving forward and of regrouping if difficulties arise.

Create a classroom culture that focuses on producing positive emotions by promoting students' self-confidence. Explain to your students that making errors is natural and that mistakes provide opportunities to learn and can lead to future understanding. Help them set appropriate goals for mastering the materials. Choose learning situations and resources that help students see learning as interesting and valuable. You can also promote positive emotions by celebrating progress, encouraging some element of risk-taking, and scaffolding procedures that students can use when mistakes or difficulties occur.

Teach students strategies to control their emotions. Such strategies can vary from relaxation techniques, meditation, and mindfulness exercises to specific strategies for students who need help de-escalating when they are upset in class.

Suggested readings: Carey, Devine, Hill, Dowker, McLellan, & Szucs, 2019; Coleman, 1966; Pekrun, 2014; Szucs & Mammarella, 2020..

Conclusions

Teachers can make a big difference in helping students develop their capabilities for independent, lifelong learning by giving them time to engage in meaningful and constructive tasks on their own or in collaboration with their peers and by helping them in the successful completion of these tasks. We stressed the importance both of acquiring scientific knowledge about learning to counteract students' incomplete information and misconceptions, and of explicitly teaching learning strategies. In addition to acquiring the necessary cognitive and metacognitive skills, students also need to develop the motivational and emotional capabilities that make it possible for them to persist in pursuing their learning goals, even in the face of failure, and to control negative emotions. The capabilities of a self-regulated learner are not easy to develop. Nevertheless, much can be done if teachers understand the important role they can play in this process, help students to know themselves as learners, and teach them the strategies they can use to process information and manage their motivation and emotions.

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