

Singapore's 21st Century education vision of **Thinking Schools, Learning Nation** has set the precedence for a change in mindset and teaching paradigm in our local schools and institutions of higher learning. In this issue, we bring to you a selection of articles by various educators, both local and foreign, on their experiences with the teaching of **Thinking Skills**.

Thinking Skills in Education: Ideal and Real Academic Cultures

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Thinking, that is, the ability to reason systematically with logic and evidence is a valuable human attribute. Thinking is learned and can help people become original, creative, and innovative problem-solvers. However, many educational systems do not systematically develop thinking skills in students. In my own education up to the bachelor's level, nobody consciously or systematically taught me how to think. Consequently, I have made it a principle of my teaching to introduce thinking skills to my students through my course organisation and delivery.

Thinking Skills: Going Beyond Conventional Learning/Teaching Approaches

I provide learning tasks that involve thinking, that is, assignments that require students to look for connections among concepts, relationships between evidence and conclusion, and apply concepts and relationships to solve practical problems. However, this attempt to go against conventional teaching and focus on making students think has been frustrating.

Some of my students resist thinking by criticising my approach to teaching as unreasonable. For example three years ago, in my research methods course, I began to use an active participation and problem-based approach. I asked students to read suggested texts and gave them a list of concepts. Based on the texts and the concepts, I asked students to go through application questions in small groups and provide me with unresolved issues that would form the basis of my interactive presentation

to the whole class. Many of the students criticised this approach on the grounds that they expected me to give lectures, and that my presentation on a selected topic should come before the small-group exercises on the topic. In my laboratory sessions, students would usually get perfect scores in the production of statistical outputs, but they performed dismally on interpretation of the outputs because it involved thinking. Pat Rogers' insight helped me to manage this frustration. According to Rogers (2001, p. 121),

Indeed, they [students] will be quite resistant to any task that demands thinking and understanding because associated with their conception of what learning entails are strongly held convictions of what constitutes good teaching. They expect to be fed "right" answers by experts who tell them what to do and reward them for following the rules. They see the teacher as bearing all of the responsibility in a course, including selecting material, presenting it and testing what students have learned (that is, memorized)—a teaching practice that has been termed "closed" (Gibbs, 1992, p. 6).

The good news, however, is that at the end of the course, students demonstrated enhanced thinking skills. This experience supports Gibbs' (1992) research findings that students show increased sophistication in their conceptions of learning when they experience more open-ended learning tasks. What these studies do not show is the frustration of students later on when they take courses

that are closed-ended. The problem is with the normative educational practices that promote shallow learning. In many of our educational institutions, “learning” usually means learning facts; students who demonstrate they have learned the facts generally earn the highest grades (Giarrusso, *et al.*, 2001, p. 8).

Despite the prevalence of such surface learning approach in educational institutions, one of the major expectations of the social sciences and humanities is that they produce students skilled in critical thinking. According to Giarrusso, *et al.* (2001, p. 8), college students are expected to understand entire systems of knowledge and to develop analytical reasoning and thinking. There is a contradiction between expectation and reality here. In a teaching seminar that I attended on critical thinking, a university counsellor made an incisive remark that he was frustrated by the contradiction between professors’ rhetoric of supporting critical thinking and yet setting examination questions that usually demand regurgitation of course material.

What Teachers Can Do to Promote Thinking Skills

The works of Kolb (1984), Gibbs (1992), Rogers (2001), and Giarrusso, *et al.* (2001) about deep learning suggest that teachers can help students develop thinking skills through their course organisation and delivery. The following are the typical suggestions:

1. Present concepts, ideas, theories, methods, perspectives, and facts of the disciplinary area in integrated wholes rather than bits and pieces. Teachers should motivate students to identify, understand, and explain the relationships among the pertinent dimensions of the issues.
2. Present students with problems and provide them with supportive climate to take the risk to learn what they need to know in order to solve them. The focus here is on the process of solving the problem, not the problem to be solved.
3. Provide students with assignments that require them to work in small discussion groups in class and outside of class. This framework encourages students to think and develop effective strategies to negotiate meaning and manipulate ideas.
4. Provide students with questions and exercises that will compel them to make sense of experiences, concepts and theories from many viewpoints.
5. Present students with assignments that require making evaluations, drawing conclusions and explaining.

It is important to note that although teachers may play an important role in promoting thinking skills, students also have their part to play.

What Students Can Do to Acquire Thinking Skills

According to O’day (1993) and Giarrusso, *et al.* (2001), students can develop critical thinking on their own when they know that thinking is about assessing the credibility of what they hear, read, and present; not accepting anything at its face value. O’day (1993, p. 31) specifically stresses that learning to think critically appears more difficult than it really is. Students can develop thinking skills simply by asking simple questions of What? Where? When? Why? Who? and How?

Questions to stimulate thinking when examining communication:

- What is the purpose of the communication?
- What does the communication assume or take for granted? Is the assumption correct, reasonable?
- Are the key concepts of the communication clearly defined?
- What is the main idea/thesis/argument of the communication?
- Is the communicant’s point of view biased or neutral? Does it consider alternative points of view?
- Is the evidence relevant and adequate?
- How was the evidence collected?
- Is the interpretation of information reasonable?
- What explanation is provided? Is it convincing?
- Does the conclusion flow from the discussion and the facts?
- What are the implications and consequences that flow from the conclusion?

It is crucial to point out that teachers and students may have all the competencies to develop thinking skills, but they will not succeed in promoting and learning thinking skills, respectively, if the education system and the larger society do not value thinking. Given the paucity of thinking skills development activities in the education system, the sociological conclusion is that thinking is not highly valued. Consequently, teachers and students are not provided with the incentive to develop and apply it. The larger society does not demand that the education system promote thinking among students because it does not realise that the valuable qualities of originality, creativity, and innovation are the products of thinking, and that thinking is a learned behaviour.

The Role of Normative Practices in Promoting Thinking Skills

The acquisition of competencies to promote thinking skills is necessary but insufficient to develop thinking skills in the education system. For competencies to work

in any substantial way, the normative practices in both the education system and society at large must provide adequate incentives for thinking. Teachers who symbolise thinking are not adequately rewarded. In some cultures, there is the notion that the reward of teachers, like pastors, is in heaven not on earth. Furthermore, academia rewards doing research more than helping students to develop thinking skills. Students who apply critical thinking in their classes are usually not popular among their classmates and teachers. Moreover, students do not necessarily need to acquire and apply thinking skills to succeed in the education system and society.

Conclusion

Thinkers are original, creative, and innovative. When society values these attributes and believes that they are learned rather than innate qualities, it is likely that it would provide teachers and students with enough incentives to develop thinking skills. Originality, creativity, and innovation are valued and rewarded in the larger society

but it is assumed that these qualities are innate. It is the responsibility of educators to show the larger society that thinking is learned, and it is thinking that produces originality, creativity, and innovation. And it is precisely these qualities that are the means for creating wealth and solving social problems.

References

- Giarrusso, Roseann, *et al.* (2001). *A Guide to Writing Sociology Papers* (5th ed.). New York: Worth Publishers.
- Gibbs, Graham. (1992). *Improving the Quality of Student Learning*. Bristol: Technical and Education Services.
- Kolb, D.A. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, NJ: Prentice Hall.
- O'day, Danton H. (1993). *How to Succeed at College: The Complete Student Guide*. Oakville: Trilobyte Press.
- Rogers, Pat. (2001). 'Using Theories about Student Learning to Improve Teaching'. In Janice Newton, *et al.* (Eds.). *Voices from the Classroom: Reflections on Teaching and Learning in Higher Education*. Aurora, Ontario: Garamond Press. ■

Fostering Thinking in Large-group Teaching and Small-group Tutorials

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Treat people as if they were what they ought to be, and you help them to become what they are capable of being.

—Johann Wolfgang Von Goethe

Undergraduates are assumed to be capable of creative and critical thinking, and problem-solving skills. With large classes of over a few hundred and over-crowded syllabuses, explicit teaching of thinking skills during lectures and tutorials is not considered a practical choice.

In recent years, the adoption of problem-based learning by the Medical Faculty at NUS, the para-medical department at Nanyang Polytechnic and the engineering faculties at NTU and other polytechnics has taken tertiary education forward towards self-directed learning and thinking-through learning.

Teaching for Thinking, Teaching of Thinking, and Teaching about Thinking

The teaching of thinking should include three components for a balanced programme (Costa, 2001):

Teaching **for** Thinking

Teaching **for** Thinking means that lecturers/tutors should examine, monitor and create conditions that are conducive to undergraduates' thinking. This indicates that lecturers/tutors should:

1. pose problems, raise questions and intervene with paradoxes, dilemmas and discrepancies that challenge and engage students' minds.
2. structure the learning environment for thinking—exhorting it as a goal, valuing it, making time for it, securing a variety of materials (manipulatives, rich data resources, technology and raw materials) to support it.

3. gather evidence of, reflect on, evaluate and report on thinking.
4. respond to students' ideas positively so as to create trust, allow risk-taking and be experimental and creative. This requires non-judgemental listening and the probing of students' and each other's ideas and assumptions.
5. strive to improve and model the behaviours of thinking that are desired in students.

Teaching **of** Thinking

The Teaching **of** Thinking requires that lecturers/tutors instruct students directly in the processes of thinking through carefully crafted tasks, requiring the use of thinking skills such as “competence and contrast”, “analyse, evaluate and synthesize” and “organize and sequence” (Commonwealth of Virginia, 1995).

Teaching of Thinking not only includes teaching the steps and strategies of problem solving, creative thinking and decision making, it also includes habituating those attitudes, dispositions or habits of mind that characterise effective, skilful thinkers. Such habits are formed over time by opportunities created to apply them in a variety of settings and contexts. Students should be able to develop scientific dispositions and habits of mind including:

- curiosity
- demand for verification
- request for logic and rational thinking
- consideration for premises and consequences
- attention to accuracy and precision
- patience and persistence

Teaching **about** Thinking

The focus on Teaching **about** Thinking in learning is metacognition. Metacognition in learning may be characterised by having discussions with students about what is going on inside their minds while thinking is occurring, comparing different students' approaches to problem solving and decision making, identifying what is known, what needs to be known, and how to produce that knowledge. Interestingly, it has been found that good problem-solvers employ metacognition—planning a course of action before commencing a task, monitoring themselves during execution of a plan, backing up or adjusting a plan consciously and evaluating themselves upon completion. Metacognition in learning involves awareness of one's goals and intentions and reflections taken to achieve these goals.

It may seem difficult to promote reflective learning in a large lecture class. A simple and effective way to engage students' attention and reflection during a large lecture class is to get students to spend the last FIVE minutes to write down three points in the lecture which they consider most important to them and give justification for their choices. A more elaborate device is to keep a learning log, registering the learning activities and reflecting on these learning activities.

Lecturers'/Tutors' Behaviours That Enable Student Thinking

Lecturers' behaviours that invite, maintain and enhance students' thinking can be classified into three major categories:

- **Questioning** to challenge students' intellect and recollect information, process the information into meaningful relationships, and apply those relationships in different situations. Questions can focus students on their own emotions, motivations and metacognitive processes.
- **Responding** to students so as to create a trusting environment and to help maintain, extend and become aware of their thinking.
- **Modelling** behaviour that reflects desirable intellectual capabilities and dispositions lecturers would encounter in everyday problems and strategies.

Questioning

Skilful questioning strategies can engage and transform students' minds. Higher Order Thinking Questions are a powerful tool to challenge students' intellect. Application questions invite students to think creatively and hypothetically to use imagination, to expose their value systems or make judgement. These questions could powerfully lend themselves to the process of research because the answers cannot be found in books or in databases. If the lecturer/tutor desires student behaviours at the level of application, the following verbs could be used to elicit the desired cognitive behaviour:

- | | |
|------------------------|------------------|
| • applying a principle | • model building |
| • imagining | • predicting |
| • evaluating | • extrapolating |
| • judging | • speculating |
| • hypothesising | • forecasting |
| • generalising | • transferring |

Responding

The following five patterns of response behaviours—using silence, facilitating the acquisition of data, accepting without judgement, clarifying, and empathising—can be employed to create an environment in which students can experience and practise complex and creative thought processes.

• Wait Time (Silence)

Wait Time 1 is the length of time a lecturer/tutor pauses after asking a question. Wait Time 2 is the length of time a lecturer/tutor waits after a student comments or asks a question. A minimum of three seconds of pausing is recommended. With higher-level cognitive questions, five seconds or more of wait time may be required for achieving the desirable results. Wait Time 3 is pausing and modelling thoughtfulness after the student asks the lecturer a question.

It takes time for students to be able to think. The use of longer pauses during tutorial discussions provide students with the necessary thinking time that helps them manage their impulsivity and take responsible risks as they answer questions posed by the lecturer/tutor.

- **Facilitating the Acquisition of Data**

If lessons are to process data by comparing, classifying, making inferences, or drawing causal relationships for themselves, then data must be available for them to process. Facilitating the acquisition of data means that the lecturer/tutor should provide information on available resources to students on request.

- **Accepting Without Judgement**

Non-judgemental acceptance provides conditions in which students are encouraged to examine and compare their own data, values, ideas, criteria, and feelings with those of others as well as those of the lecturer/tutor. There are two types of non-judgemental acceptance: acknowledging and paraphrasing.

Acknowledging

Acknowledgement is responding by simply receiving without judging what the student says. It communicates that the student's ideas have been heard. Examples of this type of response are "That's one way of looking at it" and "I understand".

Paraphrasing

Paraphrasing is responding to what the student says or does by rephrasing, recasting, translating or summarising. Lecturers/tutors can use these responses when they want to extend, build on, compare, or give an example based on what the student has said. By using different words, the lecturer/tutor attempts to maintain the interest and accurate meaning of the student's idea.

Help Students Analyse Their Own Answers

Lecturers/tutors need to encourage students to analyse their own answers through probing questions. Giving direct feedback to students on the strengths and weaknesses of their answers would discourage analytical and metacognitive thinking.

- **Clarification**

The intent of clarifying is to better understand the students' ideas, feelings, and thought process. By clarifying, the lecturer/tutor shows the students that their ideas are worthy of exploration and consideration but that the full meaning is not yet understood. When a lecturer/tutor spends time, responding to students' comments by encouraging them to elaborate further, students become more purposeful in their thinking and behaviour.

- **Empathising**

Empathic acceptance is a response that accepts feelings in addition to cognition. Lecturers/tutors respond

empathically when they want to accept a student's feelings, emotions or behaviour.

Modelling

Modelling tends to reinforce students' perceptions of values and goals stated by the lecturer/tutor. By exhibiting the kinds of behaviour desired in students, lecturers can strongly influence students' behavioural patterns. Examples of desirable patterns modelled are:

- listening attentively to one another
- solving problems in a rational scientific manner
- managing impulsivity, reacting calmly and patiently during stressful situations
- accepting students' differences
- showing enthusiasm for challenges, puzzles and complex tasks
- seeking feedback and evaluation of their actions from others
- admitting that they do not know an answer but designing ways to produce an answer
- having a clearly stated value system and making decisions consistent with that value system.

Conclusion

Thinking is best effected through group work or pair work. This may seem to be a difficult task for a large lecture class but *Think-Pair-Share* is an easy activity to manage even in a class of a few hundred students.

Undergraduates at NUS and NTU had indicated that tutorials and Project Work provide better opportunities to develop thinking skills than mass lectures. Interactions of any form and problem-solving activities would stimulate and foster thinking in students.

The Singapore Thinking Programme had been implemented in all schools and at all levels by 2001. In 2003, SATI scores will be one of the criteria considered for admission into the local universities. By 2005, Project Work will be another criterion added to the list of university admission criteria.

It is hence rational and imperative for all tertiary institutions to carry on the effort to develop our high flyers into critical thinkers and creative problem-solvers.

Recommended Reading

1. Commonwealth of Virginia. (1995). *Standards of Learning for Virginia Public Schools*. Richmond Board of Education, Commonwealth of Virginia.
2. Costa, Arthur L. (Ed). (2001). *Developing Minds: A Resource Book for Teaching Thinking* (3rd ed.). Alexandria, Virginia, USA: Association for Supervision and Curriculum Development
3. Forgarty, Robin. (1994). *Teach for Metacognitive Reflection*. Arlington Heights, Illinois: Skylight. ■

Nurturing Thinking Skills

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Higher order thinking requires the manipulation of ideas and information in ways that derive new implications and meaning or modify existing ones. Through such processes as combining ideas and facts to hypothesise, generalise, synthesise, explain and arrive at interpretations or conclusions, students can be led to discover new meanings and solve problems. This article briefly presents, discusses and gives examples of strategies for developing **analogous**, **sequential** and **interpersonal thinking**, three higher order thinking skills (Senge, *et al.*, 2000) which need to be nurtured because they are essential to individual holistic development.¹

Analogous thinking begins to develop at a young age and involves comparisons and analogies among separate events. Sequential thinking emerges later when patterns are discerned between events and is commonly applied in mathematical questions involving numbers and patterns in series. Interpersonal thinking, the highest order of these three skills, involves individual personal and social development.

To enhance the development of thinking skills, educators need to provide students with a plethora of application opportunities during lessons and assignments. Doing so not only broadens horizons but also simultaneously helps to develop multiple perspectives. Moreover, the crux of this learning involves a transformation of the way in which learning occurs. In higher education, students should be provided with opportunities to make connections between different events and situations in order to nurture emotional as well as cognitive capabilities.

Efforts should also be made to build the confidence needed for effective interactions with people who have an even wider variety of attitudes, backgrounds and opinions. In a nutshell, students need support, motivation and tangible as well as intangible rewards for continually increasing their

abilities to cope with and, indeed, conquer complex situations and problems as needed. So, how is this done? More specifically, what strategies can nurture these thinking skills?

First, the Internet can be used to help students examine and learn from authentic, real-life situations in their content areas. Moreover, opportunities, challenges and motivation to choose their own research topics can also enhance learning. For example, health-related web sites, which include patient histories and nutrition as well as exercise sources, can be explored. Students can then role-play as doctors or health and fitness experts, explaining a patient's condition and prescribing wellness programmes. Similarly, in another content area, students can explore a web site for a geographical location of their choice and role-play as community leaders, identifying problems and proposing beneficial solutions and policies. These types of learning experiences will, therefore, connect students to actual world events. Consequently, they can actively participate, gain increased transferable knowledge and become better prepared for their lives outside of the classroom. Furthermore, they can become more motivated and see themselves as valuable contributors as well as problem solvers. This can help to increase awareness that many options are available and that they can make a wide variety of choices that affect themselves and their families.

Secondly, the cultivation of good questioning techniques can help students to become critical thinkers who successfully relate to and continually test systems around them. They need to be able to look for themes and connections in what may

1. Educators, however, need to be aware that when using higher order thinking skills, instructional outcomes are sometimes unpredictable because elements of uncertainty are introduced. In contrast, when students merely receive or recite factual information or employ rules through repetitive routines, lower order thinking occurs (Newmann and Wehlage, 1993).

initially appear to be isolated events and situations, thus sharpening analogous thinking abilities. This can be included in assessments and assignments, which are specially designed to give students an opportunity to apply specific skills. Students can be helped to develop these techniques by using scaffolds such as who, what, when, where and why questions as well as templates modelling different organisational patterns, which are used in academic writing.

Thirdly, students can be asked to do group work and present their findings in a stock and flow diagrammatic flow chart (Senge, *et al.*, 2000) or mind map and a brief oral and/or written presentation or report. By organising research and thoughts into a visual pattern, they will learn to show interrelationships that emerge and increase abilities to keep track of causes and effects. Such presentations can also positively develop writing skills as well as their abilities to map and effectively communicate concepts, encouraging coherent thinking while solving complex problems. In addition, group presentations can help participants to share a vision, develop a joint sense of purpose and raise cognitive capabilities to higher levels. This simultaneously fosters the development of emotional as well as cognitive and linguistic sensitivities, which is especially needed when communicating with people from different backgrounds and opinions.

Finally, to promote effective thinking skills, a learning experience should conclude with a teacher asking mediating questions, which assist students to reflect upon what has actually taken place and other choices that could have been made.

Questions raised in this process could include:

1. What were your main objectives or goals?
2. What actually happened? Are you surprised by this outcome? Why? How did your assumptions and deductions differ from the actual outcomes? What do you think caused this discrepancy?
3. Could your results have been different? How could you do this differently to achieve outcomes similar to the actual ones? What do you think you will try to do next in your subsequent assignments and projects?

These questions have important implications because they allow students to see for themselves the process of learning which has just occurred. These active participants are also empowered to take control of their own learning and to begin developing a vision for projects or tasks as well as an appreciation of the consequences of different actions, which can be taken. Priorities can subsequently be modified to achieve reasonable standards and to communicate findings, thus effectively using higher order thinking in the processes of integrating analogous, sequential and interpersonal thinking skills.

References

- Newmann, F. and Wehlage, G.G. (1993). 'Five Standards of Authentic Instruction'. *Educational Leadership*, 50(7), pp. 8–12.
- Senge, P., Cambron-McCabe, N., Lucas, T., Smith, B., Dutton, J. and Kleiner, A. (2000). 'Practices'. In T. Lucas (Ed.). *Schools that Learn: A Fifth Discipline Field Book for Educators, Parents and Everyone Who Cares About Education* (1st ed.). London: Nicholas Brealey Publishing, pp. 153–166. ■

An Exercise in Thinking, Writing, and Rewriting

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Science teachers often complain about their students' thinking and writing, but often do not know what to do to improve them. Here I describe an exercise that addresses both challenges at once with first year university students in a special programme.

Early in a year-long interdisciplinary programme that includes all sciences, I assigned an article in the current primary literature [Schwenk, K. (1994). 'Why snakes have forked tongues'. *Science*, 263: 1573–1577]. In the same week, we asked a simple question in tutorial: "Could a bacterium of a given size sense a concentration gradient with different parts of its body at the same time, or would it need

a memory? Can gradients be that steep?" The problem is difficult and its answer is interesting. I won't bother you with those details here; my point is about the form of the work, not its content. I asked students to write a paper on the general problems of using information to guide movement; not just by snakes or bacteria, but by any mobile animal. Other well-formed, sufficiently open and challenging problems would serve as well. Each author was also assigned first and second editorship of two other students' papers; everyone got 3 grades for the exercise.

A secretary date-stamped the submitted papers and gave them to the first editors. They inserted comments and wrote essays about the authors' conceptual approach, much as scientists do in reviewing papers for journals. (Most editors had to interview the authors to be clear enough to respond effectively, which was revealing.) Editors also rewrote authors' papers for them; what they thought authors would have written had they expressed more clearly what they were thinking. Authors re-wrote their papers, second editors reviewed and rewrote them again, and then the authors produced final drafts and handed them all to me.

In one night, I commented on the evolution of 65 papers but judged the quality of only the final drafts. I judged authors' receptiveness to insightful feedback, and commented at length if editors missed anything important or ideas were so interesting that I couldn't resist. In both grading and commenting, I stressed the effectiveness of the author-editor collaborations in clarifying and strengthening scientific arguments, and the willingness of editors to serve authors when editing and not just themselves.

Final drafts were readable, enjoyable, and revealing, and papers became more distinct from each other as they progressed through the drafting. The exercise was a monument to editors, authors, and the community of scholarship we were building. It was an enjoyable evening's work for me and a lot of fun and challenge for everyone. Best of all, the students **demand**ed to do a similar exercise the next term. Science had become part of their lives, and they loved it. (*They learned a lot too.*)

For more on my general approach to teaching, which emphasises the development of creativity in students, please see:

- Gass, C.L. (July 1998). 'Teaching for Creativity in Science: An Example'. *CDTLink*, **2(2)**: 6–7. Centre for Development of Teaching and Learning, National University of Singapore.
- Gass, C.L. (2002). 'Introduction to the special feature: educating for integration and sustainability'. *Conservation Ecology*, **5(2)**: 31. [online] URL: <http://www.consecol.org/vol5/iss2/art31>.

For a description of the special programme, please see:

- Benbasat, J.A. and C.L. Gass. 2002. 'Reflections on integration, interaction, and community: the Science One programme and beyond'. *Conservation Ecology* **5(2)**: 26. [online] URL: <http://www.consecol.org/vol5/iss2/art26>. ■



The Centre for Development of Teaching and Learning (CDTL) engages in a wide range of activities to promote good teaching and learning at the National University of Singapore, including professional development, teaching and learning support, research on educational issues, and instructional design and development.

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