What Did You *Ask* at School Today?*

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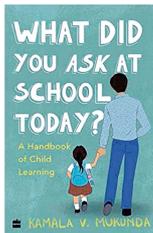
What Did You Ask *at School Today?*, written by Dr Kamala V. Mukunda, is a book that brilliantly throws light on the intricate cognitive and affective aspects of a student's mind. It draws attention to the need to comprehend these hidden processes, and also some sociocultural factors that may help or hinder optimal teaching and learning. At the outset, it should be clarified that although the book is described as *A Handbook of Child Learning*, the content applies to learners of all ages—to school as well as college education, and to learning in science, arts (humanities and social sciences), and all other disciplines. Although examples are given from child learning, these can be extended to learners in all fields.

As mentioned by the author, the title of the book has been borrowed from Richard Feynman's account of what his mother used to ask him during his school days. John Jay Bonstingl elaborates on this facet in his book, *Schools of Quality* (2001). Feynman's mother would want to know, not his grades, or what he learned at school, but what questions he asked (p.50). Mukunda's book allows us to understand that the title question can be answered, depending on how it is interpreted. One interpretation (and its implication) is that questions asked by students are excellent indicators of how and what they have learned. Another possible interpretation is that although learning based on what is taught at school may be important, due attention should be paid to the raising of questions by students. It is now known that a whole lot of complex neural and cognitive processes underlie learning, that enable true understanding on the learner's part. If these processes are nurtured, they facilitate the development of a questioning mind.

The details of the processes implicit in learning are presented in eight chapters. The first three chapters deal with fundamental brain functions, the specific processes underlying reading and arithmetic, and attention and its behavioural manifestations. This is followed by two chapters that deal with learning styles and teaching for understanding, respectively. The sixth chapter provides a thought-provoking account of issues that are encountered in classroom teaching, namely, those of gender stereotypes that may result in under-utilization of student potential. The seventh chapter deals with difficulties in reading, arith-

metic and attention, often found in school children. The final chapter critically examines the use of technology in teaching, in the form of the digital classroom. In each chapter, relevant research evidence is cited, along with a discussion of debated issues.

Clichéd as this may sound, the book contains something for everyone, including students, teachers, researchers in various fields, and those interested in the teaching of science. Particularly for those involved or interested in science education, the book may be of special value. In addition to the details about the neurological processes that activate cognitive processes that most chapters provide, three chapters draw attention to aspects that science teachers may miss: one is the chapter on learning styles (Chapter 4), the second one, the chapter on gender stereotypes in the learning and teaching of STEM (Chapter 6), and the third one, the chapter on the digital classrooms (Chapter 8). The presentation style resembles that of popular science writings. The content smoothly incorporates answers to 'How?' (process-related) and 'Why?' (cause-effect) questions, supported by arguments as well as empirical evidence for such answers, rather than mere description. Moreover, all the chapters include debates that have given impetus to research in the field of cognitive psychology and education. For students specializing in education or psychology, this book can be recommended as a reference book. For those in other disciplines, or anyone curious to know more about a child's learning at school, it would be a fascinating book for general reading.

In order to give prospective readers an idea of what the book contains, a few snippets from each chapter are presented below.

The first chapter, titled 'The Developing Brain', begins with a simple example of nerve transmission, and an introductory description of the structure and functions of the brain. Research-based information is then provided about neuro-developmental processes such as neurogenesis, synaptogenesis, myelination, and the role of neuro-developmental toxins in disorders like autism and ADHD. A caution is briefly sounded about being over-enthusiastic about neuroscientific evidence, and about making important decisions regarding school education based on such information.

The second chapter analyzes 'Reading and Arithmetic in the Brain', and deals with how a child acquires verbal and number-related skills. The accompanying brain mechanisms, as well as, the expressed responses are described in detail. With regard to reading, the complexity of this process is demonstrated through some intriguing research findings. For example, the functioning of the visual word form area (VWFA) in the brain is what accounts for reading. Two parallel routes of processing in the brain have been identified, one that decodes meaning, and the other, that converts graphemes into phonemes and enables pronunciation. Moreover, reading silently (focusing only on visual aspects, at least apparently) differs from reading out

loud (incorporating visual as well as auditory components). With regard to arithmetic, it is pointed out that arithmetic involves the processing of 'place value', something that does not exist in the processing of words in reading. The intra-parietal sulcus, an area of the brain, is responsible for processing three aspects required for arithmetic, namely, visual, language, and quantity. The process is summarized in the phrase "mental number line".

The author highlights the role of evolutionary bases of dealing with numbers, left-to-right as well as right-to-left horizontal number line, the significance of the frontal and parietal lobes, seeing 'beauty' in equations, the distinction between counting and calculating numbers, and knowing the result of a calculation, why fractions are more difficult to process than integers, symbolic and non-symbolic understanding, and similar aspects. In addition, the possible contribution of personality traits such as empathy and impulsivity, to the development of reading and arithmetic skills has been examined.

'Attention and Behaviour' are analyzed in the third chapter. The content of this chapter is generally similar to what would be included in a psychology textbook, but with some variations. The topic is introduced with the suggestion by Michael Posner that an all-pervasive cognitive process like attention should be considered an 'organ system'. The major sub-processes of attention are discussed, namely, executive function, the automatic mode of managing executive control (as shown in multi-tasking), and mind-wandering as well as mindfulness. Working memory as the functional representative of attention is explained, with a focus on four core functions, namely, cognitive inhibition, cognitive flexibility, top-down processing and bottom-up processing. Examples of all of these sub-processes are given from common experiences of teachers, such as multiple repetitions of the same error by students, and also special phenomena such as the Stroop task—the latter, in the form of a word-picture Stroop task instead of the familiar colour Stroop task. In addition to a brief but informative account of the neurological basis of attention (for instance, the role of the prefrontal cortex), the chapter provides a very useful description of the 'tools curriculum', a practical teaching method aimed at improving executive function.

The fourth chapter deals with the issue of 'Learning Styles', one that has been debated in recent research. Learning style refers to the way individuals use "attention, memory and thinking to learn" (Mukunda, p.127, 2019). When the concept of learning styles was proposed, the notion that different children adopt different approaches to learning was supported enthusiastically by some experts. Essentially, a learning style indicates the learner's preferred mode of encoding information, in terms of the form of the incoming information. Several taxonomies of learning styles have been proposed that classify learners based on various dimensions, such as the sense-modality involved, or wholist versus part-wise processing. For example, the VARK model proposes four kinds of styles, namely, visual, au-

ditory, reading/writing, and kinesthetic. Visual learners prefer pictorial material and images and also process information using spatial features. Auditory learners prefer to learn by listening rather than by seeing. Those who learn through reading and writing choose to process words or verbal material. Kinesthetic learners prefer to learn through action. There are many other classifications as well. The author cites evidence to show that there are actual variations in learning style among students. Ideally, teaching should be geared to students' preferred modes of learning. However, envisaging many obvious practical obstacles in pursuing this goal, several conceptual and assessment-related issues need to be underlined. A few of these may be cited: the multiplicity of learning style models, the existence of 'unclassifiable' learners, the problems in assessing learning style through standard tests, having students with different learning styles in the same class, and matching the teacher's teaching style with the students' learning styles. In the concluding section, the author appropriately points out that in our country, the educational system is conventionally tailored for a particular way of teaching and learning. In such an environment, the concept of learning style may have only limited utility, if any.

'Teaching for Understanding' is the subject of the fifth chapter. If one wonders whether teaching can be for anything other than understanding, diverse answers are available in this chapter. It addresses the issue of teaching in such a way that learning does not end up be-

ing mechanical. Citing examples of meaningful and mindless learning, the importance of meaningful learning is explained. Moreover, conceptual-level understanding has to be distinguished from 'misunderstanding'. The fact that memory is an essential component of understanding is analyzed, and it is pointed out that meaningful learning by the child can be identified when the taught concepts are stored in memory, remembered consistently, can be applied appropriately, and can be explained by the learner to another person, in his/her own words. Moreover, teaching for understanding necessitates an appreciation of three forms of knowledge, namely, autobiographical knowledge, declarative knowledge and procedural knowledge, and they are all expressed through memory. Moreover, different bits of information need to be understood in a 'relational' form, and this requires abstract knowledge, exemplified in analogical reasoning. Providing details of how understanding develops in the child, it is pointed out that understanding can be identified when there is a conceptual change, along with a cognitive emotion expressed as an 'Aha!' experience (as in what psychologists call insight), and when all aspects of procedural knowledge are incorporated. Moreover, understanding is not achieved through spoon-feeding, and it comes as a spectrum, or in varying degrees of learning, rather than as an all-or-none phenomenon.

Chapter six, 'Untapped Potential', would probably surprise most readers. The chapter title suggests that the chapter deals with the problem of under-performing students, and

provides tips on how to help them improve, and express their abilities to the fullest. But the chapter, in fact, focuses on gender stereotyping in the teaching of STEM (Science, Technology, Engineering and Mathematics) and goes into the details of how biases about the propensity of girls and boys to learn these subjects can actually lead to major errors of judgment on the part of teachers and others in an educational system. Such a situation often leaves students' potential in various fields inadequately brought out and nurtured, and of course, affects their performance. Overall, proficiency in STEM is associated with males more than females, and the liberal arts and humanities, with females more than males. Such stereotypes can be explicit, or more commonly, implicit. The author describes how such stereotypes affect male and female enrolment in STEM, and eventually their careers. Extensive research-based information is provided about the contexts and ways in which assumed gender differences are expressed, including biological and psychological dimensions. Attention is drawn towards two approaches, one that focuses on gender differences, and the other, that focuses on gender similarities.

In chapter seven, the author deals with 'Reading, Arithmetic and Attention Difficulties', resulting from neurodevelopmental disorders. One may recall that the development of reading and number-related skills, and the brain processes associated with them were discussed in detail in the second chapter. Often, teachers encounter students with problems in reading, dealing with numbers, and in general, demonstrating difficulties in attention processes. The discussion focuses on how such difficulties place hurdles in a child's learning and require special efforts on the part of teachers. Dyslexia, dyscalculia and attention deficit hyperactivity disorder (ADHD) are commonly encountered disorders. The author asks whether it is even appropriate to label these difficulties as 'disorders', considering that these are largely determined by a multitude of social and other variables. It is then pointed out that literacy and numeracy are indispensable in life, that difficulties in these two domains may have neural bases, and that recognizing these deficiencies as 'disorders' may ensure access to the required remedial action. Distinctions are drawn between various kinds of learning disorders, namely, spectrum, brain-based, multi-factorial, universally prevalent, and co-morbid disorders. Confusions among teachers and parents regarding diagnosis and treatment of reading and arithmetic disorders, as well as ADHD, and the consequent problems that children face, are analyzed.

The last chapter, Chapter eight, deals with issues arising out of the advent of 'Digital Classrooms'. The fundamental debate, namely, whether the digital mode of education is better or worse than the traditional nondigital mode, is not completely new. The author takes up both known and new questions related to the use of information and communications technology (ICT) in education in our country. As expected, there are positives and

negatives associated with teaching through a digital classroom. The interesting feature of this chapter is that it shows how the learning of present-day students who are 'digital natives' is affected by digital media. This is done by citing very relevant and fascinating research findings. One has to keep in mind variations among learners in access to digital media, interest and sophistication in using such resources, and cognitive characteristics such as reading and spatial ability, previous knowledge and control of attention. Many computer users get into the habit of visiting hyperlinks intermittently. This may lead to a propensity for learning through information-gathering rather than understanding, create a cognitive load in information, and require simultaneous processing of different kinds of information. Specific characteristics of digital natives as learners are described, namely, non-sequential learning, a tendency to do multi-tasking, and their preference for images over textual material (corresponding to the visual learning style). The section on ICT in India may be an eye-opener for some readers. In general, the chapter highlights both the rewards and costs of using digital media in teaching. A clear message is that no matter how useful such media can be for teaching (for example, in initiating and carrying out projects, or making the typical class more interesting), and no matter how good digital natives may be at using digital resources, computers cannot be a substitute for good teachers.

Despite the simple and easily readable style, the reader needs to have a certain background in order to fully appreciate the content. Most of the chapters require at least two thorough readings, depending on the reader's familiarity with the topic dealt with. Besides, it is not easy to mention what aspects can be improved upon, or modified. One has to express gratitude to the author for putting in immense effort to ensure that all those who are eager to know the elaborate facets of learning get valuable information. The person who created the excellent illustrations deserves congratulations— these sketches give the book a refreshingly different look compared to that of a typical textbook. More such books from the author would be welcome.

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