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How to make India's education system 21st century-ready

Teaching computational thinking to students can equip them with foundational and higher-order thinking skills

 OPINION ([HTTP://WWW.HINDUSTANTIMES.COM/OPINION/](http://www.hindustantimes.com/opinion/))

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Navigating the challenges and opportunities of the 21st century requires flexible and creative thinkers who can adapt to an increasing pace of change. The mainstream education system in India is not creating such thinkers. (Getty Images/iStockphoto)

Navigating the challenges and opportunities of the 21st century requires flexible and creative thinkers who can adapt to an increasing pace of change. Mainstream education system in India is not creating such thinkers. The problem is as much about how students are taught, as much as it is about what is being taught. We need to teach students in the same way as we want them to act; creatively, collaboratively, constantly iterating and driving to output with structure and logic. And we need to teach them content that helps them interpret many of the new challenges. Teaching computational thinking (CT) answers both challenges.

Computational thinking is the thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer—human or machine—can effectively carry out. Its constructivist, play-based approach to teaching and the CT content are what our schools need for developing 21st century learners who will not only become

better job seekers but also job makers.

We believe that introducing CT education early on would be game-changing in Indian schools. India's education system has struggled to teach both foundational and as well as higher-order thinking skills, and CT education at early ages could be a highly effective way of trying to fill these gaps. While other interventions are also touted for addressing such gaps, we believe CT education is particularly important for the Indian context.

Catching up with the global trend

Educational agencies around the world are now recognising the potential of CT education. In the largest global curriculum change in the past decade, CT is being introduced to children as early as in kindergarten and primary school.

Finland, which leads on traditional education benchmarks, is reinventing itself by integrating CT across existing subjects. As automation and productivity increases are replacing execution-oriented jobs, and other countries are moving ahead, India cannot afford to fall behind.

Developing students' thinking skills

A quality CT course is not just about learning a programming language. In these classrooms, learning is project-based and teachers are facilitators. They focus on getting students to work in groups and reflect on their own thinking processes. Teaching coding and CT from an early age is important, as the benefits of developing higher order thinking skills are greater in earlier ages.

Adaptable to low resource settings

Contrary to popular belief, schools can deliver a well-designed CT course even in low resource environments. Much of the core of such courses do not even require computers. A movement called CS Unplugged includes several activities and lessons on how to teach computational concepts and ways of thinking without any technology. These activities try to get students to understand fundamental concepts in an intuitive way. For example, to teach students about sequence in algorithms, a teacher might ask students to write out the steps to making an ice-cream sundae.

The thinking required to instruct someone to make this sundae is the same step-by-step thinking needed to design algorithms. At higher levels, where devices can enhance the learning by making the concepts come alive, one lab equipped with 20 to 30 low-cost tablets or laptops per school could be adequate.

Allowing for different paces of learning

Interactive coding courses that have access to devices can allow students move at their own pace. Teachers are encouraged to group students by ability and students do much of their learning by doing, and so can take more or less time as needed.

An implicit route to better teaching

The majority of students in India do not experience interactive and best practice teaching. There have been many calls over the years to improve teaching quality and make learning more child-centric. The 2005 NCERT guidelines have tried to make child-centred and constructivist pedagogy the norm in all subjects. However, it is difficult to change the way teachers currently teach.

Coding and CT education is new to many schools, and so teachers are often looking to learn how to teach it. Teacher training on coding education becomes an excellent opportunity to promote child-centred learning. Since coding and computational thinking courses for this age group are project-based and naturally interactive, a child-centred pedagogy is more likely to actually happen in the classroom. Our own research also shows that when teachers experience teaching in a more interactive manner in one subject, they often transfer those habits into other subjects.

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Computational thinking education in India is feasible

India has started to recognise the importance of equipping the country's future generation with CT skills. There are budding programmes across a spectrum of delivery formats: hardware-driven, software-driven, in-school, after-school and in boot camps.

The central government's policy think-tank NITI Aayog recently launched Atal Tinkering Laboratories (ATLs) in schools across India with a vision to 'Cultivate one Million children in India as Neoteric Innovators.'

The government is providing the hardware infrastructure to foster makers for 500 schools to begin with. Several organisations have developed programmes and curricula and are currently piloting them in schools across the country. For example, curricula like that of CSPathshala has created an open-source curriculum for grades 1-8 which is being piloted in over 100 schools this year. Andhra Pradesh has been experimenting with the Google Code to Learn course in over 300 of its residential and tribal schools. However, the overall scale of these programmes is still a drop in the ocean compared to the 1.2M schools in the country.

The way forward

If we are to truly get quality CT education into every school in India, we will need to convince state governments to adopt it as a core part of the curriculum. The key to this lies in taking an experimental approach that encourages many more prototypes to emerge, linked together by a structured evaluation framework that build evidence for what works. The cultural and physical diversity of India requires that the essence of computational thinking education be adapted to multiple contexts. Governments will engage when they see evidence of outcomes and a pragmatic path to implementation. Much like what computational thinking education teaches us, now is the time to build on the various small-scale initiatives to test, debug and create for scale.

Ultimately, if campaigns such as Make in India are to succeed, we need more creators in India. Hence, serious investment reform in how we develop our human capital is required. A good computational thinking education initiative can be the catalyst for that change.

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