Preparing students for the digital age

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Why CT?

- Top skills by 2025: Critical thinking and analysis, complex problem-solving, (Future of Jobs 2020 report, World Economic Forum (WEF))
- Problem Solving & Computational Thinking as a fundamental skill, NEP 2020
- Prepare students for the digital age
- Equip them with foundational CT skills: problem solving skills and critical thinking skills

ICT in schools

- How many keys on a keyboard?
- How many reserved words in C++?
- Define PRINT statement in BASIC
- Expand the following:
  - IMAP
  - HTML
  - URL
  - MODEM
  - MTA
  - ENIAC

- Computing as a collection of facts and jargon
  - Historical, irrelevant information
- Programming as a disconnected activity
  - Emphasis on Programming Languages (4-5 taught in schools)
  - Fixed collection of programs

We need bring Science into Computing

CSpathshala

- ACM India initiative, since 2016
- Promote computational thinking in K-12
- Students:
  - 400,000 students learning CT (2/3rd from govt schools in rural areas)
  - 30,000 schools in TN learning CT integrated with Math since 2018
  - 450,000 students participated in Bebras India Challenge across 20 states
- Teachers:
  - 15,000+ teachers from 5000+ institutes trained through 135+ webinars
- Community: CTiS, Webinars, Excellence Award, TACT Grand Challenge

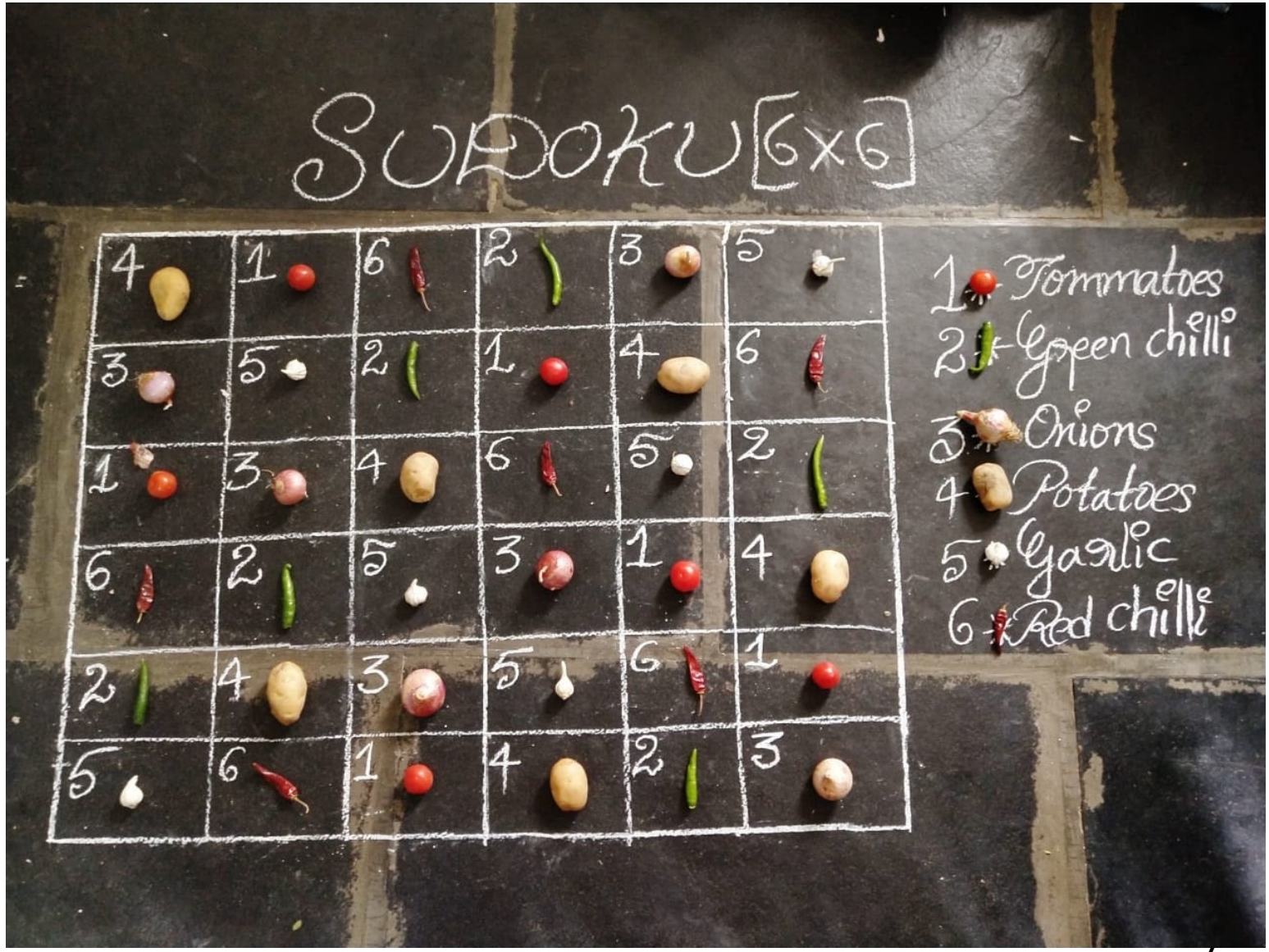
Approach and Curriculum

- Advocacy: Continued efforts with AP Social Welfare & Tribal Welfare, Maharashtra, TN
- Influence policy => NEP 2020
- Equitable => Unplugged approach: teaching computing without computers, free
- 2/3rd are rural government schools, showing Computational Thinking is for all!
- Curriculum & Content:
  - 200+ teaching aids for grades 1-8
  - included in Introduction to Coding for CBSE for Grades 6 to 8
- Books: Cambridge University Press has published books as a derivate of the content

CT Implementation: Counting Combinations

Adaptation by teachers to local context

Generalization & systematic counting: Sudoku



Patterns

Discrete Modelling: Graph paths

Algorithms

Challenges in adoption of CT

- Computer Science or Information Communication and Technology (ICT), is not part of the mainstream curriculum in schools and
- Does not have a formal prescribed curriculum for primary and middle school.
- Adoption of the CSpathshala curriculum was driven by choice and the decision was taken by the top management
- Finding time in a crowded curriculum
- What changed - inclusion of CT in NEP2020

NEP2020

Section 4.25 mentions that:

> It is recognized that mathematics and mathematical thinking will be very important for India ’s future and India’s leadership role in the numerous upcoming fields and professions that will involve artificial intelligence, machine learning, and data science, etc. Thus, mathematics and computational thinking will be given increased emphasis throughout the school years, starting with the foundational stage, through a variety of innovative methods, including the regular use of puzzles and games that make mathematical thinking more enjoyable and engaging. Activities involving coding will be introduced in Middle Stage.

NEP2020 - Benefits

- Easier acceptance of CT
- Shift of Computational Thinking as part of mainstream
- Multiple routes integration with Math and other subjects
- Inclusion: rural, semi-urban and government school students who were typically excluded will now benefit with the opportunity to learn computing
- Dedicated time for CT in the academic calendar
- Provision for teachers training

NEP2020 - Challenges

- CT is beyond coding - systematic approach to problem solving.
- In urban schools, it can lead to new subjects like AI and ML, entirely missing the conceptual basis of CT
- Plethora of progamming language, syntax

Role of CSpathshala

- Advocacy
  - CT be taught at par with Mathematics and Sciences.
  - To ensure that inclusion of CT does not reduce to programming
  - Advocacy with State Governments
  - Position paper on CT
- Inclusion: Teaching computing without computers
- Empowering Teachers
  - Teacher Training
  - CTiS Conference

Empowering Teachers

CSpathshala experience: Change mindset of teachers to train students to develop the ability to solve problems and explore multiple solutions to solve problems. Teachers training is an important component for successful implementation of CT

- Conducting interactive sessions through activities,
- CT Knowledge,
- Problem solving skills and logical reasoning
- Systematic approach
- Creativity and local adaptation of content
- Designing questions,

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