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ACM India and iSIGCSE Chapter Webinar Series on Education
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https://www.youtube.com/watch?v=Ybxnfv2O3k4

Padhu Seshaiyer
VAIBHAV
Vaishwik Bharatiya Vaigyanik Summit
GLOBAL SUMMIT OF OVERSEAS AND RESIDENT INDIAN SCIENTISTS AND ACADEMICIANS - OCT-NOV 2020

VERTICAL

Quantum Technologies
Computational Sciences
Materials and Processing Technologies
Earth Sciences
Social Sciences

Artificial Intelligence and Machine Learning (AIML)
Data Sciences
Energy
Health Medical and Biomedical Devices
Management

Electronics and Semiconductor Technologies
Photonics
Environmental Sciences
Pharmaceuticals and Bio Technology

Communication Technologies
Aerospace Technologies
Advanced Manufacturing Technologies
Agro Economy and food Security

Padhu Seshaiyer
EDUCATION FOR ALL
What **knowledge and skills** does a **computer scientist** need to be successful?

Padhu Seshaiyer
What knowledge and skills does a computer scientist need to be successful?
OBJECTIVES AND PROPOSED ACTIVITIES

• Discuss practices related to teaching/learning computing.
• Discuss and disseminate research related to computing education.
• Discuss elements of teaching and pedagogy.
• Discuss computing programs and curricula.
• Disseminate education technologies and use of tools/software in computer science education.

In addition, iSIGCSE also aims to provide resources, conduct workshops to improve the quality of computer science education research and computer science teaching, particularly in the context of India.

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YOUR RESPONSES

Notice & Wonder

- Definitively getting at some point of time
- The fourth is the best, but takes more effort.
- If you don’t have the right tools, hope for the best.
- A tool that suits a situation shall be used.

- Even after having some amount of resources as others, you lack something: skill/energy/enthusiasm
- Based on your height, you need a ladder of different height to reach the apples. Similarly, based on the skill levels of the students, additional effort is needed to reach the desired goals
- The same height ladder may not be good for all
- Let me approach from a different angle to explore the alternate way for capturing the fruitful answer

Passively waiting for the apple
- Luck alone may not favor everyone
- You may not be always lucky

Acquire required skills
- Take extra effort to acquire the required skill so achieve your goals. Perseverance pays.
- Use the right tools in the right way to get what you want to achieve.

Adapting to the changing technological landscape
- Use elevate the design thinking to approach the solutions
- Adjust the heights according to the need.

Share ideas, technology, resources for the welfare of all without being selfish.
- Make efforts to enjoy apple (by climbing) also straighten and protect the apple tree to enjoy fruits for many years by many people even with same type of ladders

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Inclusion
Universal Design
Equity
Instruction
Learning space
Curricular materials

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Equitable participation in computing education

Access
Availability of CS to all students

Diversity
Student participation reflects school demographics

Inclusion
All students are engaged and learning

- Culturally responsive teaching and learning
- Engaging curriculum
- Universal design

Padhu Seshaiyer
"Congratulations to Dr. Padmanabhan Seshaiyer, a 2021 NCWIT Aspirations in Computing (AiC) Educator Award recipient! Dr. Seshaiyer was selected from more than 300 applicants from all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, Guam, and all U.S. overseas military bases. The AiC Educator Award identifies exemplary formal and informal educators who play a pivotal role in encouraging high school and collegiate students who self-identify as women, genderqueer, or non-binary to explore their interest in computing and technology."

TRANSFORMING INDIA

'NATIONAL EDUCATION POLICY 2020'

Contributing to an equitable and vibrant knowledge society, by providing high-quality education to all.

- Curricular Integration of Essential Subjects, Skills, and Capacities
- 4.24. In addition to proficiency in languages, these skills include: scientific temper and evidence-based thinking; creativity and innovativeness; sense of aesthetics and art; oral and written communication; health and nutrition; physical education, fitness, wellness, and sports; collaboration and teamwork; problem solving and logical reasoning; vocational exposure and skills; digital literacy, coding, and computational thinking; ethical and moral reasoning; knowledge and practice of human and Constitutional values; gender sensitivity; Fundamental Duties; citizenship skills and values; knowledge of India; environmental awareness including water and resource conservation, sanitation and hygiene; and current affairs and knowledge of critical issues facing local communities, States, the country, and the world.
23. Technology Use and Integration

23.2. New technologies involving artificial intelligence, machine learning, block chains, smart boards, handheld computing devices, adaptive computer testing for student development, and other forms of educational software and hardware will not just change what students learn in the classroom but how they learn, and thus these areas and beyond will require extensive research both on the technological as well as educational fronts.
24. Online and Digital Education: Ensuring Equitable Use of Technology

• 24.2. However, the benefits of online/digital education cannot be leveraged unless the digital divide is eliminated through concerted efforts, such as the Digital India campaign and the availability of affordable computing devices. It is important that the use of technology for online and digital education adequately addresses concerns of equity.
**KWL: Know, Want, Learn**

<table>
<thead>
<tr>
<th>What do you <strong>K</strong>now about the topic?</th>
<th>What do you <strong>W</strong>ant to know?</th>
<th>What did you <strong>L</strong>earn?</th>
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<tbody>
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Padhu Seshaiyer
Understanding Culturally Responsive Teaching in the Computing Community

Padhu Seshaiyer
# YOUR RESPONSES

## KWL: Culturally Responsive Teaching in Computing

<table>
<thead>
<tr>
<th>What do you <strong>KNOW?</strong></th>
<th>What do you <strong>WANT to know?</strong></th>
<th>What did you <strong>LEARN?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual Thinking and System design</td>
<td>How to bridge K-12 students with the technology development for strengthening STEM education and the grassroots innovation ecosystem?</td>
<td></td>
</tr>
<tr>
<td>Basic knowledge in Computing</td>
<td>How to get better at Competitive programming, and problem solving?</td>
<td></td>
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<tr>
<td>Basic knowledge on operating computers.</td>
<td>How to teach a new subject in computing?</td>
<td></td>
</tr>
<tr>
<td>AI/ML for systems</td>
<td>How to make teaching interesting to students? How do I teach it effectively and in an engaging manner so that students see the relevance of the fundamentals?</td>
<td></td>
</tr>
<tr>
<td>Systems and Networks</td>
<td>How to inspire students beyond what any others can do in the area of my course? How to create deep knowledge in students?</td>
<td>MT2 (Multi-Track Modular Teaching) is an excellent method</td>
</tr>
<tr>
<td>Automata Theory</td>
<td>How to adopt the knowledge gained? How to use methods like Multi-Track modular teaching in machine learning and AI?</td>
<td></td>
</tr>
<tr>
<td>AI System</td>
<td>What are machine learning and various programmes techniques and where are they being used?</td>
<td></td>
</tr>
</tbody>
</table>

Padhu Seshaiyer
Inclusive Pedagogy

- Asking yourself some questions before entering the classroom
- Using data
- Using “If-then” strategizing
- Using counter-stereotypic imaging
- Engaging in active learning in the classroom
- Handling difficult conversations

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LIKE WE'LL EVER USE THIS
Which dog grew more?
The Locker Problem

Unlocking the Locker problem
Pillars of 21st Century Skills

COMMUNICATION

COLLABORATION

CRITICAL THINKING

CREATIVITY

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How many squares are in a Chess Board?
How many squares do you see?
How many **squares** do you see?
About how many seconds are in a year?
About how many seconds are there in a year?

- There are 365 days in a year.
- There are 24 hours in a day.
- There are 60 minutes in an hour.
- There are 60 seconds in a minute.
- So the answer = 365 x 24 x 60 x 60
About how many seconds are there in a year?

- There are 365 days in a year.
- There are 24 hours in a day.
- There are 60 minutes in an hour.
- There are 60 seconds in a minute.
- So the answer $\approx 400 \times 25 \times 4000$
Fermi Problem of the Day!

How Many Seconds Are In a Year?

Do the math (I did the math, there is about 31,449,600 seconds in a year)

Approximate - reasonable estimate

When you do the math and multiply you get 31,536,000 seconds in a year.

Google it

4000 x 25 = 100,000 x 400 = 40000000

Know how many seconds in a minute. Then how many in an hour then in a day then so on.

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FERMI Problems

• How many piano tuners are there in Chicago?

• How many people in the world are talking on their cell phones in any given minute?

• How many kernels of popcorn would it take to fill this room?

• How many new passenger cars are sold each year in the USA?

• How many pennies would need to be stacked to reach the height of Mount Everest?

Padhu Seshaiyer
School Waste Composition in Numbers

Elementary School Student
- Take less food
- Instead of throwing the food away, the schools can give food to charities

Middle School Student
- Take only what you need

High School Student
- Add a compost system
  1. If you don't want something, don't grab it.
  2. Don't talk as much.

At my school, there is a box in the trash can. If you did not eat something, you can put it in the box and someone can eat it.

Design Thinking
- Empathize
- Define
- Ideate
- Prototype
- Test

PBL Project Based Learning
- Need to Know
- Driving Questions
- Public Demonstration of Knowledge
- Next Generation Skills
- Voice & Choice
- Authentic Feedback & Reflection
- Imagine & Imagine

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Chennai
- Thickly populated
- Large Slum Dwelling population.
- Migrant / Transient population (from other districts/ states)
- Below poverty level population (BPL segment)
- Unorganized Sector Workers

- Speaking with the Demand Side and understanding ground realities.
- Main Stakeholders are: Homeless people, People living below the Poverty Line, slum dwellers, Street hawkers, Orphanages and Old age homes

The Need
- A platform to connect all Stakeholders.
- A place for soliciting & managing Volunteers.
- Bringing in proper Last Mile Connectivity in the Supply chain to ensure food reaches the deprived.

Empathy
Define
Ideate
Prototype
Test

Connecting with the Supply Side
And Understanding their Role.

- Cooked Food
  - Corporate Donors
  - Restaurants
  - Marriage Halls
  - Private Caterers

- Uncooked Food
  - Grocery Shops
  - Supermarkets
  - Individual & Corporate doners.

- Other ways of Contributing
  - Monetary Contribution.
  - Volunteering – Aiding in Last Mile Connectivity, Time, Tech etc.

Completed ideation session with a sample group for building a platform to connect all stakeholders.

Initial talks with a NGP/Start-up

Padhu Seshaiyer
A Computer Scientist FERMI Challenge
How many beds will be needed to serve all acute cases of COVID-19 patients?

Seshaiyer, Mubayi and MaClean (Dec, 2020)
Computing Education
From Context to Competency

Curriculum
Concepts
Content
Competencies
Context

Padhu Seshaiyer