Current Trends and Challenges in the Teaching & Learning of Mathematics

21st Century Skills in Mathematics Education

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Current Trends and Challenges in the Teaching & Learning of Mathematics

No	Topic/Activity	Hour	Strategy	Expected Outcome

1	21st Century Skills Learning in Mathematics Education
	• Important elements in the 21st century learning (4C):
	  • Collaboration
	  • Creativity
	  • Communication
	  • Critical thinking
	• Incorporation of 4Cs into the teaching and learning of mathematics
		2	• Lecture input
			• Small group activities
			• Discussion and presentation
			• Reflection and sharing
				• Compare existing mathematics instructional practices in ASEAN region with 21st century trends and challenges in the world.
				• Propose and justify the goals of mathematics education in order to prepare students for 21st century.

What's the meaning of "**Trends**"?

- New
- Up-and-coming, and
- Popular educational practices

Why Mathematics Education is Important?

- Mathematics is a mandate to prepare ALL students for college, career, and life

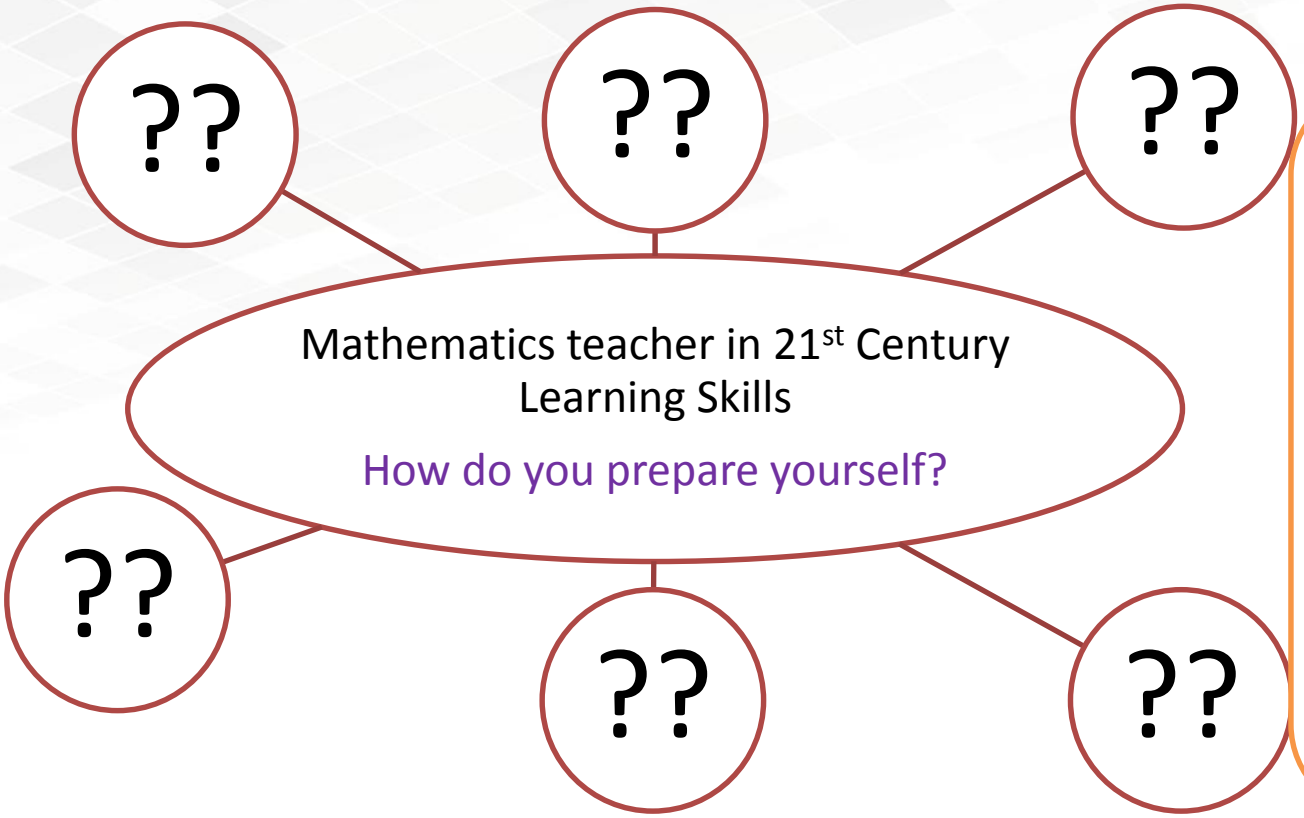
21st Century Learning Skills in Mathematics Education

No	21st Century Skill	Mathematical Practices
1	Collaboration	• Engage in collective inquiry around rigorous mathematical practices and content • Remain focused on a collaborative action orientation, experimentation, and reflection by all team members • Use assessment data to guide continuous and formative improvement of student learning and teacher instruction
2	Creativity	• creating a new fruitful mathematical concept through- so often- combining concepts or relations; • discovering an unknown relation; • reorganizing the structure of a mathematical theory

21st Century Learning Skills in Mathematics Education

No	21st Century Skill	Mathematical Practices
3	Critical thinking	• Make sense of problems and persevere in solving them • Reason abstractly and quantitatively • Model with mathematics • Look for and make use of structure
4	Communication	• Construct viable arguments and critique the reasoning of others • Attend to precision • Look for and express regularity in repeated reasoning

Activity 1: Reflections on how do you prepare to be a Mathematics teacher in 21st Century Learning Skills in Your Country



- Is that good enough to prepare yourself?
  - Knowledge
  - Skills (problem solving, thinking)
  - Soft skills (communication, team spirit, …)

Activity 2: The kou-ku theorem

This image of an ancient Chinese maths problem from the earliest known Chinese mathematical text, the Chou Pei Suan Ching, dating from around 500 to 200 BC.

It concerns the kou-ku (pronounced go-goo) theorem.

What can we relate it with Mathematics Education?

- If the bamboo is 1m tall, what are the minimum and maximum lengths of the vertical side?
- What are the minimum and maximum horizontal distances from the base of the bamboo to the point where it touches the ground?
- If you know the height of the break, how would you calculate the horizontal distance from the base of the bamboo to where the top touches the ground?
- If you know the horizontal distance from the base of the bamboo to where the top touches the ground, how would you calculate the height of the break?

In the class , we don’t have bamboo

- So change to what?

Use a concept with plastic straw

- Build your idea with this concept using straws
- There is a bamboo 10 chi high, the upper end of which, being broken, touches the ground at 3 chi from the foot of the stem. What is the height of the break? Note: a chi is about 23 cm.
- Enabling Prompts
  - what the length of the hypotenuse of the triangle would be if the break was at 2 chi.
  - If h = 0, what is the horizontal distance? If the horizontal distance is 0, what is the height?

Challenges:
What is happening in your country?

- The use of standardised testing, equity in education, and the use of adaptive learning in the classroom.
- Standardised tests: examinations that are given to students and scored in the same way in classroom across the country.

What is happening in your country?

- An emphasis has been placed on the outcome of the test.
- Classroom teaching shifting from traditional instruction to test preparation.
- Administrators and teachers feel the pressure to have their students perform well on these assessments.

What is happening in your country?

- Focus on preparing children to pass a test.
- Equity in education: how fair and equal education is to all students, regardless of socioeconomic background.
- To drop out of school before graduating high school. Tend to have more discipline issues in the classroom, and generally perform lower on standardized tests.

More concern:

1. The conflict: covering content versus meaningful learning.
   - Teacher covers a lot of content in too short a time.
   - cover content based on textbooks and curriculum-limited scope
   - teaching for a test/exam, less focus on students' mathematical understanding

2. Mathematics teachers' content knowledge

- Teachers don't know the mathematics they need to know to help students learn. Does it happen??
- Not exclusively an issue of elementary teachers, even in secondary schools.

Suggestions:

- Selective in admitting candidates and rigorous pre-service teacher preparation programmes.
- Need to be a mathematics specialist teacher

3. Teachers' understanding of student learning and effective teaching strategies

- Not enough just to know a lot of mathematics
- A good teacher need to understand how students are thinking and learning about mathematics
- how to structure instructional opportunities to support their learning
- Professional development programms for teachers such as :

  - Provide opportunities for educators/teachers to further their own content knowledge and pedagogical skills for teaching

4. Focus on quality not quantity.

- More emphasis on the process of learning rather than product
- Focus on students' understanding of the mathematics rather than just learning a method.
- Meaningful learning instead of rote learning
- Get students to communicate and share their solution process

Others…

- Student interest and motivation to learn mathematics.
- Students attitude toward mathematics
- Mathematics teacher shortage
- Teacher effectiveness

- To what extent should teacher “effectiveness” be evaluated ?

- based on student performance on common assessments?

Others…

- Opportunity (to learn) gap

  - All students do not currently have access to high quality teaching and curriculum.

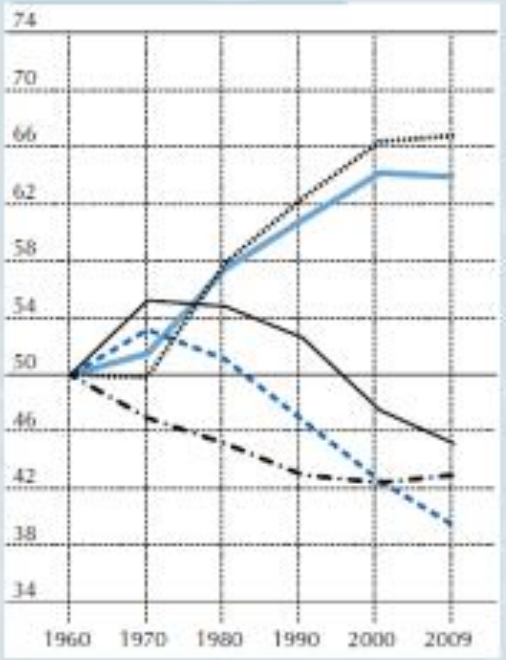
- Use of technology

  - There are teachers who use technology but teach in the same traditional way as they did without it.

Activity 3: ASEAN

No	Country	Existing Mathematics instructional practices in Your Country	21st Century trends and Challenges in the world
1	Brunei		
2	Cambodia		
3	Indonesia		
4	Lao PDR		
5	Myanmar		
6	Philippines		
7	Singapore		
8	Thailand		
9	Vietnam		
10	Malaysia		

Trends in the Demand for Skills in the US



Non-routine analytic
Non-routine interactive
Non-routine manual
Routine cognitive
Routine manual

NCTM NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Average change in task inputs across education-industry cells, in percentiles of the 1960 task distribution

What do we need to do?

Effective
Mathematics Teaching Practices

1. Establish mathematics **goals** to focus learning.
2. Implement **tasks** that promote reasoning and problem solving.
3. Use and connect mathematical **representations.**
4. Facilitate meaningful mathematical **discourse**.
5. Pose purposeful **questions**.
6. Build **procedural fluency** from conceptual understanding.
7. Support **productive struggle** in learning mathematics.
8. **Elicit and use evidence** of student thinking.

Thank you very much for your kind attention!