Presentation Scripts

## Slide 1: Opening Questions – Bridging Abstract and Tangible Worlds

Visuals: Dynamic animation of abstract mathematical symbols transitioning into real-world objects and 3D models, interspersed with students working collaboratively.

Narrator Script:

“Can you imagine lessons that bridge abstract mathematical concepts with the tangible, real-world experiences of students? Lessons that promote computational thinking and integrate data visualization and modeling? And what do lessons incorporating computational thinking, basic coding, and data science look like in practice?

Welcome to my lesson series—Mathematics Exploration with 3D Printing: Bringing Data to Life with Matrices and Models. I’m, Yosep Dwi Kristanto, excited to share with you an instructional design that transforms the way students engage with mathematics.”

## Slide 2: Theoretical Overview of the Lessons

Visuals: Diagram illustrating the DNR principles (duality, necessity, repeated reasoning) connected to computational thinking and matrix concepts.

Narrator Script:

“The lessons are built on DNR-based instructional principles: duality, necessity, and repeated reasoning. They are designed to integrate computational thinking and data visualization, helping students connect abstract mathematical concepts—like matrices—with the tangible world around them.

Duality focuses on subject matter mastery, such as matrices as data representation, alongside the development of computational thinking. Necessity creates opportunities that ignite students’ intellectual need to engage with matrices through computational thinking. Repeated reasoning provides practice, reinforcing students’ abilities to apply computational thinking within the lessons.

Together, these principles offer students a bridge between the abstract and the tangible, equipping them with tools to explore, interpret, and model their world.”

## Slide 3: Lesson Overview and Goals

Visuals: Structured flowchart showing the sequence of lessons and corresponding learning goals.

Narrator Script:

“The lesson series is designed to be progressive and engaging, with a clear structure that scaffolds learning. The goals are to help students to represent real-world data (such as temperature or topography) in matrix form, interpret the data, and visualize it through 3D modeling and printing, converting abstract data into tangible models.

The lessons are structured into three parts, each building on the last to deepen understanding and expand students’ skills.”

## Slide 4: Lesson 1 – From Visualizing Data to Decoding with Matrices

Visuals: A timeline or storyboard illustrating key activities, such as students analyzing line charts, heatmaps, and matrices.

Narrator Script:

“In Lesson 1, students are introduced to the fundamentals of data visualization and matrix-based analysis. The tasks are carefully sequenced to build their understanding of how abstract data can be represented and interpreted using visual and numerical methods.

1. The lesson begins with students observing and interpreting trends using visualizations, sparking their curiosity about temperature patterns.
2. They then critically evaluate the effectiveness of a line chart, identifying its limitations and exploring improved methods of communication.
3. Moving forward, students analyze heatmaps as an alternative visualization, comparing their effectiveness with line charts and learning to represent data as numerical matrices.
4. Students engage with matrices to extract, interpret, and analyze numerical data, discovering how trends across rows or columns can reveal meaningful insights.
5. To deepen their understanding, they practice summarizing data by reducing a matrix’s dimensionality through the calculation of averages.

By the end of this lesson, students no longer see matrices as abstract arrays but as powerful tools for decoding and analyzing real-world data.”

## Slide 5: Lesson 2 – Coding Matrices and Visualizing Heatmaps

Visuals: Screenshots of simple R code, heatmaps, and examples of student outputs like social media platform overlap heatmaps and chessboard patterns.

Narrator Script:

“In Lesson 2, the foundational concepts of matrices and visualization are expanded through the integration of coding in R, enhancing students’ computational thinking. The tasks guide students to interact with code and matrices to create dynamic visualizations.

1. Students start by exploring how simple R scripts generate heatmaps, learning how data structures relate to their visual representations. This introductory task helps students connect coding basics to data visualization.
2. They then experiment with matrix parameters such as data, number of rows, and ordering methods, gaining hands-on experience in manipulating matrices and observing how changes affect visual outputs.
3. Applying this knowledge, students work with real-world data, such as overlaps in social media platform usage, to create matrices and heatmaps that represent complex relationships.
4. As they advance, students develop customized heatmaps, including a binary chessboard pattern, learning about color palettes and structured matrix designs.
5. Finally, students transition from two-dimensional visualizations to the concept of three-dimensional data representation, exploring how matrix-based data can serve as the foundation for creating 3D models.

This progression equips students with a deeper appreciation for the versatility of matrices in representing and visualizing diverse datasets.”

## Slide 6: Lesson 3 – From Elevation Data to 3D Printing

Visuals: 3D renderings of Mount Merapi, screenshots of R code with packages like rayshader, and photographs of printed models.

Narrator Script:

“Lesson 3 immerses students in the process of transforming elevation data into 3D models, combining data analysis, coding, and hands-on creation.

1. The journey begins with students examining a 3D model of Mount Merapi, reflecting on how its visual representation connects to the underlying matrix-based data. This activity helps them grasp the concept of representing geographic information through three-dimensional visuals.
2. Students then explore Shuttle Radar Topography Mission (SRTM) elevation data, learning about data resolution and tiling while discovering its applications in urban planning and environmental modeling.
3. Using this data, they analyze its structure as a matrix and transform it into a 3D model. This step helps them understand the relationship between numerical matrices and real-world landscapes.
4. To advance their skills, students utilize R packages like rayshader and terra to work with geographic data and create detailed 3D models. They explore how coding allows them to manipulate data and visualize it effectively.
5. The final step in this lesson is a tangible one—students 3D print their Mount Merapi models, experiencing the process of transforming digital data into physical objects.

This hands-on conclusion bridges the gap between abstract data analysis and real-world applications, leaving students with a comprehensive understanding of data representation and its transformative potential.”

## Slide 7: Discussing the Potential of the Lessons

Visual Concept: Show examples of student-created heatmaps, 3D models, and coding projects alongside images of real-world applications, like maps or printed models. Include animations of data transforming into visual or physical forms.

Narrator Script:

“These lessons open up exciting possibilities for students. They don’t just learn math—they see how it connects to the world around them. By working with computational thinking, data visualization, and 3D modeling, students discover how to turn numbers and equations into something meaningful and useful.

From exploring temperature trends to designing their own 3D models, students gain skills they can use in real life. They learn to think critically, solve problems, and communicate ideas in new ways. These lessons help students move beyond abstract math, showing them how it’s a powerful tool to understand and shape the world.”

## Slide 8: Wrapping Up and Call to Action

Visual Concept: Highlight key ideas like "From Abstract to Real-World," "Building with Data," and "Empowering Students." Show students actively engaging with lessons and their final creations. Add a clear link or QR code to access the lessons.

Narrator Script:

“To sum up, these lessons are about more than learning math—they’re about making it real, exciting, and useful. By blending concepts like matrices with hands-on activities in data visualization and 3D modeling, students get the chance to explore, create, and understand in ways that stick with them.

If you're interested in learning more, I invite you to explore the full lessons. Thank you, and I hope you find the lessons engaging and inspiring!”