Understanding Mathematics in Real-Life Context Through Coding

Hatice Beyza Sezer, Immaculate Kizito Namukasa
Faculty of Education, Western University

BACKGROUND

In school settings, coding, and mathematical modelling are some of the ways in which computational thinking (CT) is utilized to **model and visualize real-world problems** for students.

Simulations of mathematical models that utilize simple tools such as Scratch (a block-based programming language) are **readily accessible** to young learners. These models can be **easily understood, read, and modified** by students, even those who have not yet mastered more sophisticated programming languages.

OBJECTIVE

This study aimed to reflect on **the opportunities of utilizing computational simulations** of the COVID-19 outbreak to enhance the computational and mathematical knowledge and skills of elementary and middle-grade students.

METHOD

A qualitative research design, specifically content analysis, was employed to examine two interactive simulations created using Scratch. These simulations are based on **the Susceptible–Infectious–Recovered (SIR) mathematical model**, which students may have been exposed to in schools and can be modified to explore various real-life scenarios.

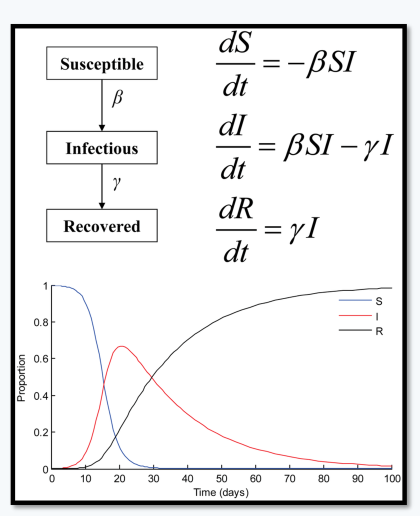


Figure 1. SIR Model (Luz et al., 2010)

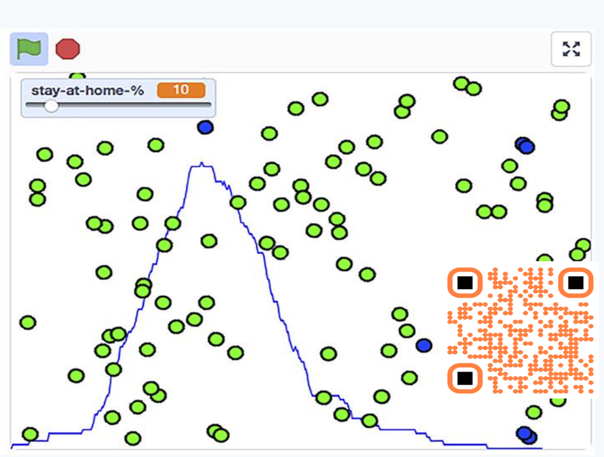


Figure 2. Epidemic Simulation (Resnick, 2020)

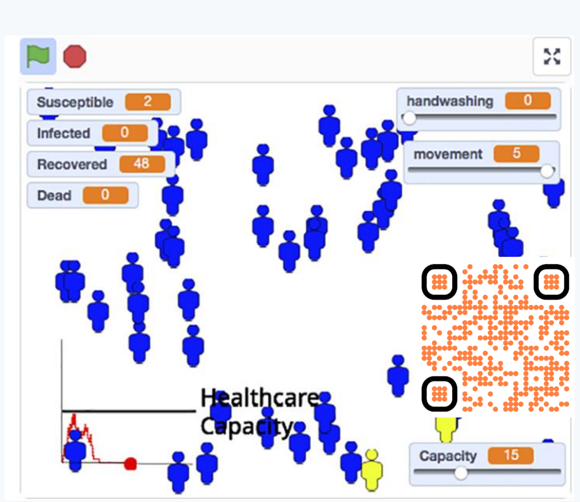


Figure 3. Infectious disease simulator with healthcare capacity (Brodie, 2020)

DISCUSSION

Given the mathematics required to **manipulate the simulations**, it appears that users might be motivated to **re-examine the code to understand it**, and, if necessary, **remix it**.

These simulations empower students to **dynamically model mathematical problems**. For instance, users can modify the initial states, steps, or rates in the simulation, providing them with the ability to experiment with various scenarios.

Tinkering with these models of real-life applications could help learners in **developing a broader and deeper understanding of using mathematical and computational concepts and tools. mathematical**

Engaging students with real-world problems may raise awareness of the impact of various levels of precautions, such as social/physical distancing, and reducing mobility by staying at home.

The possible affordances of using computational simulations through different CT perspectives (Kafai et al., 2020)

Cognitive CT
learning **mathematical concepts**: probability, coordinate geometry and **computational concepts**: repetition, and conditional logic (e.g., Weintrop et al., 2016).

Situated CT
social interaction: **collaboration and communication** through remixing (e.g., Brenna & Resnick, 2012).

Critical CT
promotes awareness: preventing the spread of COVID-19 help students to **engage with the political, moral, and ethical challenges** of the world (e.g., Lee & Soep, 2016).

Implementing coding in a real-life context helps students realize the use of mathematics in reading, understanding, and experimenting with simulations of magnitude, dynamics, and recommended responses to facilitate informed individual and collective decision-making in the current and post-pandemic world.

CONCLUSION

Using CT tools during the current global health crisis **provides a deeper understanding of the pandemic and prepares individuals for comprehending and addressing future global and local crises.**

Teachers can utilize these tools to demonstrate to students **how their mathematical and computational knowledge can be applied to real-world situations**.

Coupling mathematical models with computational thinking concepts can **assist students in understanding the role of mathematics** in real-world simulations. This enables them to **engage in more advanced simulations** and **develop informed decision-making skills**.

Full paper & References

RESULTS

In this study, we investigated the **four dimensions of sample simulations** (i.e., initialization, movements, transmission, and recovery process) and their **connections to mathematical and computational concepts** (e.g., coordinate geometry, probability, repetition, and conditional logic) by demonstrating and interpreting the coding blocks used in the simulations.

Four dimensions of sample simulations

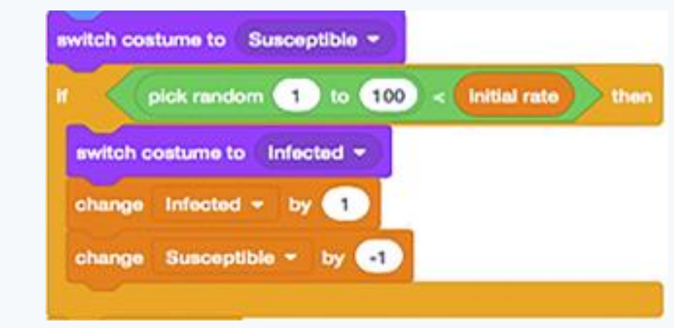


Figure 4. Coding blocks for illustrating the **initialization** step (Brodie, 2020)

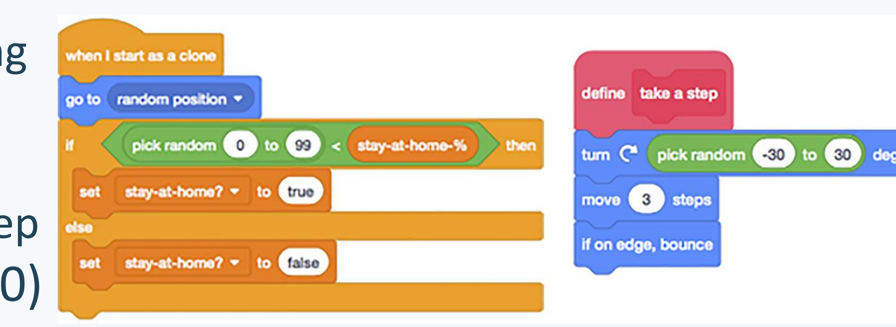


Figure 5. Coding blocks for illustrating the **movements** step (Resnick, 2020)

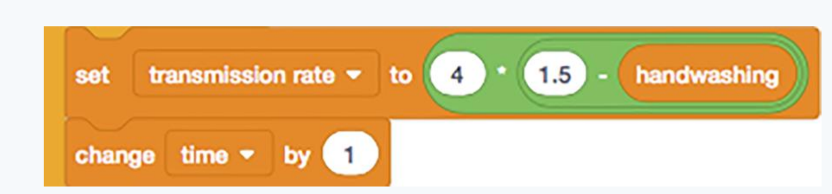


Figure 6. Coding blocks for illustrating the **transmission** step (Brodie, 2020)

Figure 7. Coding blocks for illustrating the **recovery** step (Brodie, 2020)

Connections to mathematical and computational concepts

Figure 8. The samples of the **mathematical concepts** (Brodie, 2020; Resnick, 2020)

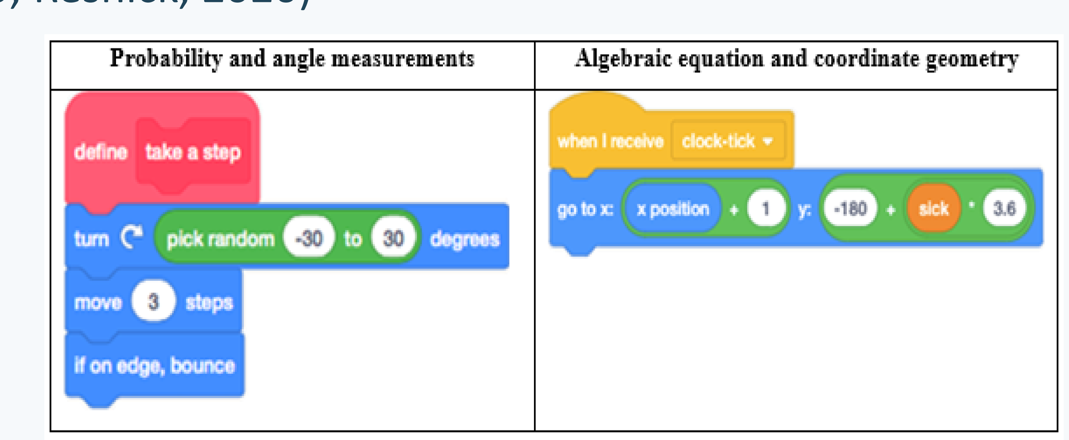
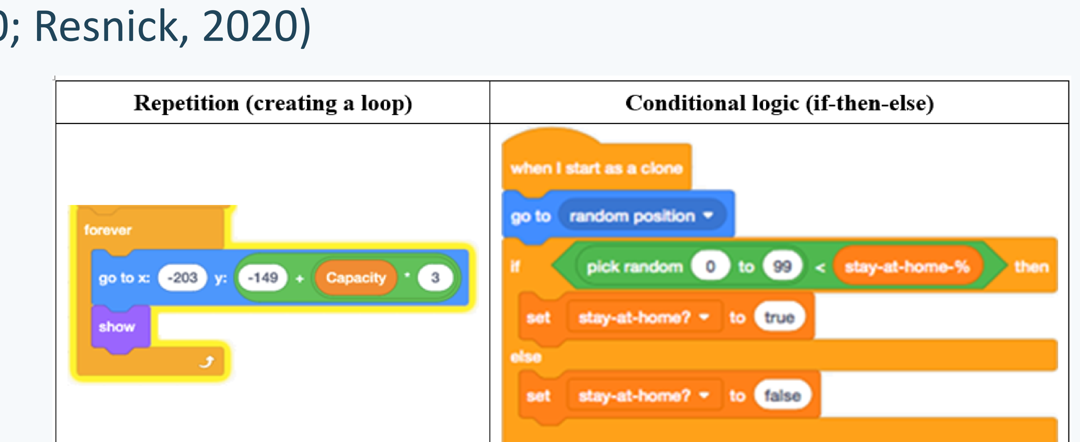


Figure 9. The samples of the **computational concepts** (Brodie, 2020; Resnick, 2020)



Western