

Introducing QR Coding into the Mathematics Classroom

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INTRODUCTION

Educationally relevant technology has long been used as an aid to teaching, and the richness and sophistication of such technology continues to increase. In addition, smartphones have become part of our lives. This is particularly true of our students who have been born into a world of mobile technology, instant information, and immediate communication. Incorporating the use of Quick Response (QR) codes in the mathematics classroom is one of many ways to capitalize on this technology in an educationally meaningful way. After installing the appropriate application on a smartphone, scanning a QR code links one directly to the desired content, be it animations, video clips, sound clips, images, or online content. This article describes an innovative activity that capitalizes on the mobility of the smartphone through the use of QR scanning, creating an engaging and motivating learning experience.



FIGURE 1: Students engaged at one of the activity stations

THE ACTIVITY

The activity described in this article, which was structured for eighth grade students, had two important goals. Firstly, we wanted to create an activity that reviewed a variety of mathematical topics that had been covered during the course of the year. These included ratio and proportion, probability, data handling, percentages, Pythagoras, estimation, the solving of linear equations, and the drawing of graphs. Secondly, we wanted to enrich instruction through the incorporation of various smartphone Apps and functionalities. These included the QR code reader, WhatsApp messaging, phone camera, and phone calculator. QR codes for each of the four activity stations were generated using <https://www.the-qrcode-generator.com/>. The activity took place over two consecutive lessons. The first lesson was used for the activity itself while the second lesson was used for discussion, further engagement with questions and exercises, as well as general feedback.

PREPARING FOR THE ACTIVITY

All students were required to download the QR code reader onto their smartphones prior to the first lesson. At the beginning of the activity the pupils were divided into four groups and each group was assigned to start at one of the four activity stations which were scattered at different locations around the school. During the course of the activity the four groups would cycle through the activity stations so that all groups had the chance to engage with each activity. Each group was handed an initial activity sheet for their designated starting station.

On arrival at their activity station, students had to scan the QR code placed at that specific location in order to access the various tasks associated with that particular station (Figure 2). Any supplementary data that was required was available from the particular staff member present at each of the activity stations. Once the students had completed the various tasks they took a photo of their work and sent the photo via WhatsApp to their teacher. The teacher then checked the answers and, if correct, the next activity location was revealed.

<p>Library</p> 	<ul style="list-style-type: none"> • Scan the QRC, answer the questions, and write the answers on the page. • Photograph your answers and send them to the teacher for confirmation using WhatsApp. • When you receive the confirmation from the teacher, show it to the librarian, and she will give you the location of the next station.
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FIGURE 2: Example of the instructions in the library station

ACTIVITY STATION 1 - LIBRARY

The topics covered at this particular station included ratio and proportion, probability, data handling, and percentages.

Station 1 – Library

The school library has many types of books: reading books, science books, technology books, poetry books, and children's books. In total, the school library has 25 028 books.

A Ask the librarian:

A1 How many science books are in the library

A2 How many technology books are in the library?

A3 How many books (on average) are removed from the library at the end of the school year as a result of wear and tear?

B Answer the following:

The reading books comprise 25% of the books in the library and the ratio of the number of poetry books to children's books is 2:1. How many reading books, poetry books, and children's books are there in the library?

C C1 Prepare a pie chart showing the types of books in the library.

C2 What is the relative frequency of science books in the library?

C3 What type of book is the most common in the library?

D If you randomly select one book from the library, what is the probability that a reading book is selected? A poetry book? A technology book?

E The books are arranged on shelves each of which can hold up to 104 books. How many shelves of books are there in the library at the end of the school year after the worn books are removed?

FIGURE 3: Question page for Library

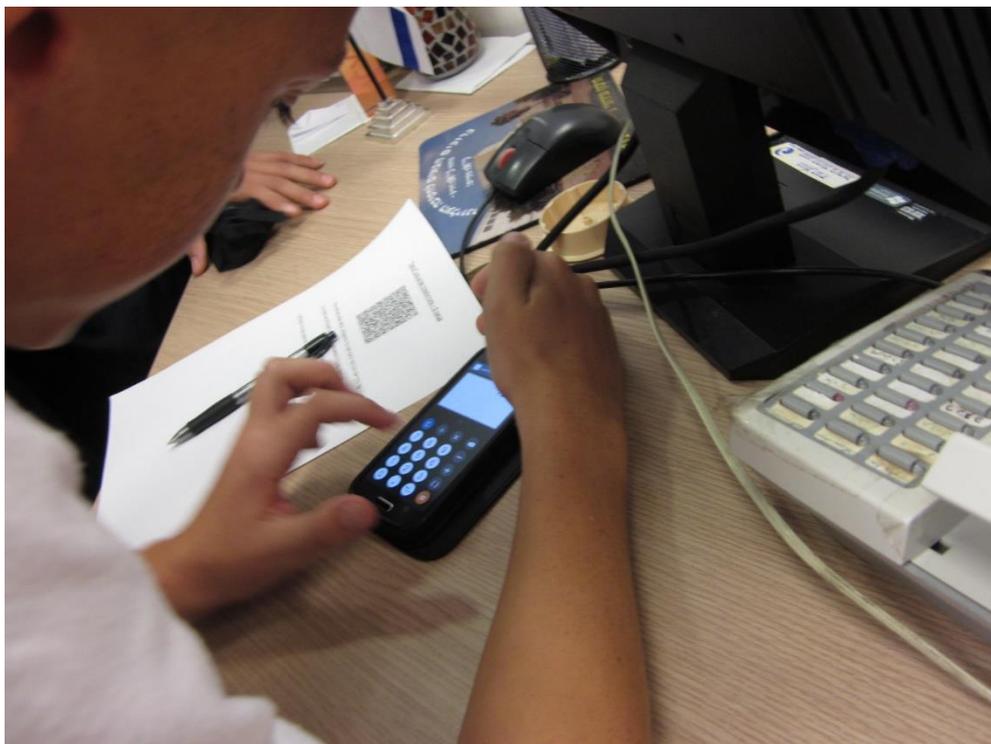


FIGURE 4: Students performing calculations on their smartphones

ACTIVITY STATION 2 – SCHOOL OFFICE

This station involved the solving of sets of linear equations.

Station 2 – School Office	
At the end of the school year, a budget was allocated to purchase cups and boxes of tea for the teachers and staff. All cups were identical and all the boxes of tea were identical. The full amount allocated was used.	
A	Ask the school secretary:
A1	What was the total amount allocated for the purchase of the cups and boxes of tea?
A2	What was the price of a single cup?
A3	What was the price of a single box of tea?
B	Answer the following questions:
B1	If 5 cups were purchased, how many boxes of tea were purchased?
B2	If 12 boxes of tea were purchased, how many cups were purchased?
C	Suggest other options for the purchase of cups and boxes of tea given that the entire sum allocated must be used.

FIGURE 5: Question page for School Office

ACTIVITY STATION 3 – TEACHERS’ COMMON ROOM

This station involved the use of variables in equations, solving sets of equations, and graphing.

Station 3 – Teachers’ Common Room	
Ask for the number of teachers in the teachers’ common room. They are about to vote on a particular motion.	
A	Indicate the number of votes in favor of the motion by x and those against by y .
A1	Write an appropriate equation and draw a graph on the Cartesian plane.
A2	Write three ordered pairs of numbers that represent a solution to the equation. Decide whether each of the solutions that you wrote down is relevant to this particular “situation” and explain why.
B	Assuming that the number of votes for the motion is 6 greater than those against :
B1	Using x and y as the variables, write an appropriate equation and draw its graph on the same Cartesian plane.
B2	How many ordered pairs exist for the equation? Give two examples and explain for each pair if it is applicable to the situation.
C	Do both equations have common solutions? What are they? What does this signify?

FIGURE 6: Question page for Teachers’ Common Room

ACTIVITY STATION 4 – STUDENTS’ STUDY ROOM

This station involved the calculation of areas along with the use of Pythagoras’ Theorem.

Station 4 – Students’ Study Room

Count the number of tiles along the length and width of the study room, which is rectangular in shape.

A Given: the size of each tile is 14 cm by 32,2 cm.

 A1 Calculate how many tiles are covering the floor of the study room.

 A2 What is the area of the classroom floor in square meters?

 A3 Calculate the length of the diagonal of one tile.

 A4 Calculate the length of the diagonal of the floor.

B The length of another classroom (also rectangular) is 6 m and its diagonal is 8 m.
 What is the width of the room?

FIGURE 7: Question page for Students’ Study Room

AFTER THE ACTIVITY

In the lesson immediately following the activity, the answers to the various questions were reviewed. This allowed time to discuss any problem areas and to engage with different approaches to solving some of the questions. General feedback regarding the activity was also captured.

INSIGHTS AND CONCLUDING COMMENTS

General feedback after completion of the activity suggests that incorporating smartphone Apps into an academic activity allowed students to feel more connected to the activity and its associated content. Almost all students who took part in the activity enjoyed it and felt that the incorporation of smartphone Apps, particularly the QR code reader, had added to this enjoyment. Another aspect of the activity that worked well was to have small groups of students at each of the activity stations. Weaker students felt more comfortable to seek help from their group members, and this fostered good cooperation and a sense of collegiality within each group. An interesting aspect of the activity is that almost all students felt that the process of having to submit answers via WhatsApp and receive confirmation of the answers before moving on to the next activity station motivated them to try harder at the next station.