LESSON DETAILS

Mental health, it's not a given!

Lesson Summary

This lesson uses data collection and analysis to draw conclusions and raise awareness about the benefits of good mental health.

Grade: 9

Big Ideas

Ask the right questions in order to collect good data.
Draw conclusions from a regression.
Have an awareness of the state of one's mental health.

Learning Expectations

AA1. develop and explore a variety of social-emotional skills in a context that supports and reflects this learning in relation to the expectations and learning content of all other areas of study

- identifying resources and supports that aid perseverance in mathematical learning
- building healthy relationships and communicating effectively in mathematics

A1. apply the mathematical processes to develop a conceptual understanding of, and procedural fluency with, the mathematics they are learning.

- reasoning and proving
- reflecting
- communicating

A2. make connections between mathematics and various knowledge systems, their lived experiences, and various real-life applications of mathematics, including careers

C3. represent and compare linear and non-linear relations that model real-life situations, and use these representations to make predictions

C3.1 compare the shapes of graphs of linear and non-linear relations to describe their rates of change, to make connections to growing and shrinking patterns, and to make predictions

C4. demonstrate an understanding of the characteristics of various representations of linear and non-linear relations, using tools, including coding when appropriate

C4.4 determine the equations of lines from graphs, tables of values, and concrete representations of linear relations by making connections between rates of change and slopes, and between initial values and y-intercepts, and use these equations to solve problems

D1. describe the collection and use of data, and represent and analyse data involving one and two variables

D1.3 create a scatter plot to represent the relationship between two variables, determine the correlation between these variables by testing different regression models using technology, and use a model to make predictions when appropriate

D2. apply the process of mathematical modelling, using data and mathematical concepts from other strands, to represent, analyse, make predictions, and provide insight into real-life situations

D2.1 describe the value of mathematical modelling and how it is used in real life to inform decisions

D2.2 identify a question of interest requiring the collection and analysis of data, and identify the information needed to answer the question

D2.4 determine ways to display and analyse the data in order to create a mathematical model to answer the original question of interest, taking into account the nature of the data, the context, and the assumptions made

D2.5 report how the model can be used to answer the question of interest, how well the model fits the context, potential limitations of the model, and what predictions can be made based on the model

Cross Curricular Connections

Connections to mental health and wellness, physical education, and/or science and technology (depending on the research area chosen by the teacher)

Learning Goals and Success Criteria:

Learning goals can be reviewed and modified according to vision and instructional intent. Criteria can be reviewed and modified in collaboration with students.

LG1 - We are learning to formulate questions to answer a research question.
SC1: I can formulate a question that can lead to a data analysis.
SC2: I can formulate a hypothesis and then test its validity.

LG2- We are learning to use statistics-related vocabulary in appropriate contexts.
SC1: I can use statistical vocabulary in appropriate contexts.

LG3 - We are learning about the coding possibilities associated with a spreadsheet (e.g. Sheets, Excel) and graphing calculator software or application (e.g. DESMOS).
SC1: I can consolidate data from a survey using a spreadsheet.
SC2: I can use collected data to perform a linear (or nonlinear) regression using software or graphing calculator application (e.g. DESMOS).

LG4 - We are learning to draw conclusions from our data collection and mathematical model.
SC1: I can identify a model that fits my data well.
SC2: I can draw conclusions from my analysis.

CONSIDERATIONS THROUGHOUT THE LESSON

Differentiated Instruction and Universal Design for Learning

Use Visibly Random Groupings to create small groups.

Data collection can be done as a class or in small groups depending on a topic of interest to the students.

The survey can be created collaboratively by the group or individually.

Given the sensitive nature of the topic of mental health, special attention will be paid to how the topic is addressed, taking into account the current realities and lived experiences of the students in the classroom. Students need to feel comfortable and safe, and frequent check-ins and special attention will be required to ensure that this climate of trust is maintained.

Assessment

Throughout the lesson, the teacher will listen to the students' mathematical discussions to assess their understanding of the concepts being studied. The teacher can use the observation chart to record observations of the students' mathematical discussions.

Exit Ticket

Feedback provided by peers in relation to the co-constructed success criteria. This also demonstrates students' understanding of the success criteria.

Self-assessment in relation to the co-constructed success criteria.

RESOURCES AND LEARNING ENVIRONMENT

Educator Resources Needed

A laptop and/or chromebook and internet access in order to access the Google Slide presentation and use Desmos online.

Google Slides Presentation to facilitate the lesson.

Prepare a form (Google Forms or other collaborative software) where students are editors and can add their question(s) for the survey. Prepare a spreadsheet (Google Sheets or other spreadsheet) with the responses received.

A copy of the observation chart

Mental Health Resources: Digital media: Promoting healthy screen use in school-aged children and adolescents

Student Materials Needed

A laptop and/or chromebook and access to the internet in order to access the Google Slides presentation and to use Desmos (available online) or another software or graphing calculator application that can perform regressions.

Google Slides Presentation to be completed by the teams during the Action.

Learning Environment Considerations

When questions are asked in this activity, ensure that students are given sufficient time to think about their answers to help foster a positive emotional environment. Use the Think, Talk, Share strategy to promote mathematical conversations to help build students' confidence.

It is suggested that the Action work be done with randomly selected groups in an appropriately arranged space.

LESSON CONTENT

Minds-on (15 minutes)

Whole class
The teacher begins the lesson by showing students a picture. Ask students what they observe. The teacher notes the observations in the Google Slides Presentation on the "What are you observing?" page. Ask students what questions they have. Record the questions on the "What questions are you asking?" page.

Ask students to think about the mental health consequences of electronic over-stimulation from their cell phones or screens (see mental health resources). If the proposed topic (screen time) is not relevant to the reality of the students in the class, a more relevant topic can be targeted. Students should be consulted to determine the topic of inquiry.

Encourage students to draw on their life experiences to inform the conversation. Some possible lines of inquiry related to screen time:

- Is it healthy to spend that many hours (2h 8m) at a screen during a day? Explain your reasoning.
- What is healthy in terms of the number of hours of electronic device use per day?
- Who determines how much screen time is too much?
- How can we decide what is considered healthy or not? Is it the same for everyone?
- Can screen time have a positive impact on a teen's life? A negative impact on a teenager's life? Explain your thinking.

Bring students to consider the impact of a healthy use of technology on their well-being (learning, social interactions, sleep, anxiety, academic performance, physical and mental health, ...). Explain that mathematics can help us understand situations better so that we can draw conclusions, and that mathematical tools such as spreadsheets and graphing calculator software or applications facilitate numerical data collection and analysis.

Action (45 minutes)

This section can also be done as a class or in small groups as mentioned above.

1- The class is divided into teams.
Each team identifies a research question related to the topic and a hypothesis to test. Each team will have to accept or refute their hypothesis at the end of the lesson.
Each group enters their question and hypothesis into the Google Slides presentation. For example: Question - Does cell phone use have an effect on the amount of sleep adolescents get? Hypothesis: We believe that the larger the amount of screen time, the shorter the duration of sleep.

It would be good here to question the students about how we can find a relationship (correlation) between two quantitative variables. We need to make sure that one really depends on the other. For example, in the summer, the number of people on vacation increases. Also in the summer, the intensity of the smell of garbage increases. These two quantities change, but one does not depend on the other. Once the student finds that two quantities are related, we can then determine whether one is the cause of the change in the other (e.g., the total amount of an electricity bill ($) depends on the amount of electricity used (kWh)), or whether the two quantities are changing because of a third variable (e.g., if A is the fact that there are fewer students attending your school and B is the fact that there are teachers leaving your school, then we could think that A is the cause of B. Fewer students means that the school needs fewer teachers. But, it may be that upon further analysis, we find that fewer students is not the cause of teachers leaving. There is C, the fact that there is a new school that has just opened in your neighborhood, that is the cause of a transfer of students (A) and also the cause of teachers leaving (a new school attracts teachers (B))).

2- The team must create a plan to collect data to answer a question or questions that will then be added to the survey (Google Form or other) prepared by the teacher. Tell the students that they should not repeat questions that have already been added by another team. For example, for the impact of cell phones on sleep, the group could ask: "What is your daily screen time in minutes? How many hours do you sleep per night?"

3- The completed survey is shared with all students so that they can input their answers (data). The data collected is used for further analysis. The teacher then creates a spreadsheet with the data and shares it with students.

4- Data analysis can begin. The students will select a tab from the spreadsheet (one tab per team) to paste the data that is relevant to answering their initial question about the relationship they chose to study. The students should make a prediction about the shape

of the trend that they expect to observe on the graph (e.g., when the independent variable increases, what should happen to the dependent variable?) The student should also make a prediction about the linearity (or not) of their graph.

5- Use the linear regression feature in Desmos to see if there is a trend in the data, to analyze the correlation coefficient to determine how well the trend line fits the scatter plot. Does the relation behave like a straight line? Use r, which quantifies the strength of correlation between the two variables. Explain its meaning, using the table of correlation coefficient values. See the steps for regression in Desmos.

6- From the graph, draw a conclusion about the relationship and compare it with the initial hypothesis. Are they able to answer their question? Ask students to insert the conclusion and graph into the Google Slides presentation. Also, ask students whether or not they think the linear model is appropriate for the situation. Ask students about the reasonableness of their results and have them evaluate the model they generated.

Possible questioning:

- Can the model really answer the question? If not, is it necessary to revise the assumptions that were made at the outset, or to collect better data?
- Are there alternative models?
- Have you considered the right questions or do you need to rethink the original problem?
- What were the most surprising connections seen today?
- What have you learned about your topic using technology?
- What tips do you have for avoiding the screen in times of stress?
- How and where could we use this data?
- How could we have improved the results of our analyses?
- Are there any biases that occurred during your data collection? How could they have been avoided?
- How might your data be interpreted differently? What would be the purpose of this different interpretation?

Expansion opportunities

Use of code in spreadsheet cells to determine measures of central tendency (mode, median, and mean) on a single variable in order to draw further conclusions. (e.g., average number of minutes spent per day in front of the screen by students in the class).

Instead of collecting data for just the class, give the link to the survey to other teachers so that more data can be collected. Discuss with students the advantages/disadvantages of having a larger sample.

Consolidation (25 minutes)

Return the students to the large group. Using the Google Slide presentation, compare the graphs from the different teams and discuss the impact of screen time on different aspects of their well-being. Ask students what they observe in relation to the different findings.

Have a spokesperson from each group present whether their initial hypothesis was correct. When possible, students would be asked to relate their findings to one's well-being.

Challenging students to answer their question may lead us to ask more questions. Often, a data analysis does not result in a clear answer, but rather it directs our questioning in order to refine our research.

Another suggestion: Invite the students to have a conversation about mental health and its impact on quality of life. The teacher can use this opportunity to provide contact information for Kids Help Phone.

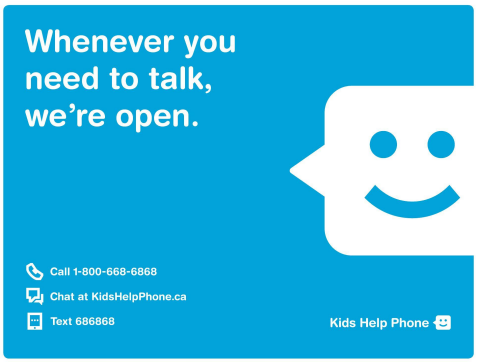
Exit ticket that can be done in writing or verbally.

Appendices

Appendix 1

Link to image source

Appendix 2



[Lien vers le site anglais de l'image - www.kidshelpphone.ca]

Appendix 3 - Exit ticket

Name: _____ **Date:** _____ **Period/Object:** _____	**Name:** _____ **Date:** _____ **Period/Object:** _____
Describe today's lesson in 3-5 complete sentences.	Describe today's lesson in 3-5 complete sentences.

Appendix 4 - Observation Chart

Observation Chart: Analysis and Data Collection

LG3 - We are learning to use statistics-related vocabulary in appropriate contexts.
SC1- I can use statistical vocabulary in appropriate contexts.

P	Actively **p**articipates in group discussions
J	**J**ustifies his or her positions
O	Demonstrates **o**penness to the ideas of others
V	Uses statistical **v**ocabulary correctly

Date → **Names** ↓									
	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV
	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV
	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV
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	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV
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	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV
	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV	PJOV

Appendix 5 - Correlation coefficient

Value of r	Strength of the linear bond	Visual description of the scatter plot
-1	perfect correlation	line with negative slope - all points are on the line
-0,87	strong correlation	line with negative slope - the points are very close to the line
-0,75	moderate correlation	line with negative slope - the points are close to the line
-0,5	weak correlation	line with negative slope - the points are dispersed but still seem to form a linear pattern
0	zero correlation	there is no pattern with the points
0,5	weak correlation	positive slope line - the points are dispersed but still appear to form a linear pattern
0,75	moderate correlation	line with positive slope - points are close to the line
0,87	strong correlation	line with positive slope - the points are very close to the line
1	perfect correlation	line with positive slope - all points are on the line