Climate Citizens: Decisions with Data

Gr. 5-8 Activity Write Up

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Climate Citizens: Decisions with Data

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Actua is creating a Canada where every child has the skills and confidence they need to achieve their full potential. As a leading science, technology, engineering and mathematics (STEM) outreach organization, Actua includes over 40 universities and colleges, engaging 500,000 youth in 600 communities each year. For 25 years, Actua has focused on identifying and removing the barriers for entry into STEM and now have national programs dedicated to engaging Indigenous youth, girls and young women, Black youth, those facing economic barriers and youth in Northern and remote communities. For more information, please visit us online at www.actua.ca and on social media: Instagram, LinkedIn, Facebook and YouTube! For more information, please visit us online at www.actua.ca and on social media: Twitter, Facebook, Instagram and YouTube!

Climate Citizens: Decisions with Data

Activity Summary

In this activity, participants will learn about data and its use in training AI systems. Participants will explore different types of climate data and then roleplay as entrepreneurs, ideating an AI-powered climate app. After designing the app and seeking peer feedback, participants will play an interactive board game where they collect data and try to train their AI system.

Developed by Actua, 2025.

Delivery Environment	Activity Duration	Intended Audience	Tech
In-Person	2 Hours	Grades 5-8 (*Ages 9-14*)	Certain activities will require a laptop/tablet. With modifications, it is possible to run this entire lesson in pairs/groups. **Facilitators should have access to a laptop, projector, speakers, and a screen or blank wall to project onto.** • Projector • Speaker • Screen/Blank Wall • Laptop/Tablet

Achievement Goals

Learning Goals

Following this activity, participants will:

- **Learn** how data is used to train an AI system.
- **Ideate** an AI app that uses climate data.
- **Explore** how climate data can be used in society.

Success Criteria

Following this activity, participants can express:

- **I can describe** how data is used to train an AI system.
- **I can design** an idea for an AI climate app.
- **I can explain** to someone how climate data can be used in society.

Logistics (Timing, Group Sizing, Materials)

Section Title	Time	Group Size	Materials
Opening Hook	10 minutes	*Whole Group*	**Facilitators** • Climate Citizens Activity Slide Deck (*Appendix C*) • Chart Paper / White Board • Writing utensils
Section 1: My Climate App	25 minutes	*Small Groups (3-4)*	**Facilitators** • Climate Citizens Activity Slide Deck (*Appendix C*) **Per Group** • My Climate App Template (*Appendix C*) • Writing Utensils

Section Title	Time	Group Size	Materials
Section 2: App Expo	20 minutes	*Whole Group*	**Facilitators** • Climate Citizens Activity Slide Deck (*Appendix C*)
Section 3: Data Dash	45 - 75 minutes *this section may need additional time	*Whole Group*	**Facilitators** • Climate Citizens Activity Slide Deck (*Appendix C*) • Data Dash Rules (*Appendix C*) **Per Group** • 2 Dices • 20 Bingo counters (One Colour) • 20 Bingo Counters (Another Colour) • Data Dash Game Board (*Appendix C*) • Data Dash Reference Guide (*Appendix C*) • 3-4 Player Tokens (*Appendix C*) • Data Dash Data Tokens (optional) (*Appendix C*) • Data Dash Player Tokens (optional) (*Appendix C*)
Reflection & Debrief	10 minutes	*Whole Group*	• N/A

Safety Considerations

Safety considerations have been provided below to support safety during this activity, however they are not necessarily comprehensive. It is important that you review the activity and your delivery environment to determine any additional safety considerations that you should be implementing for the delivery of these activities.

Emotional Safety - Climate Change

- Conversations around climate change can be challenging for some participants. Ensure that conversations around climate change do not centre around guilt or shame and focus on what can be done in the future, not what has happened in the past.

Curriculum Links

This activity aligns with these components found in the UNESCO AI Competency Framework for Students:

AI Techniques and Applications: AI Foundations

- Learners are expected to develop basic knowledge, understanding and skills on AI, particularly with respect to data and algorithms, and understand the importance of the interdisciplinary foundational knowledge required for gradually deepening understanding of data and algorithms. They should also be able to connect conceptual knowledge on AI with their activities in society and daily life, concretizing a human-centred mindset and ethical principles through an understanding of how AI works and how AI interacts with humans (p. 32-34).

AI Techniques and Applications: Application Skills

- Learners are expected to be able to construct an age-appropriate knowledge structure on data, AI algorithms and programming, and acquire transferable application skills. (p. 41).

Ethics of AI: Embodied Ethics

- Learners are expected to be able to develop a basic understanding of the ethical issues around AI, and the potential impact of AI on human rights, social justice, inclusion, equity and climate change within their local context and with regard to their personal lives. They will understand, and internalize the following key ethical principles, and will translate these in their reflective practices and uses of AI tools in their lives and learning: Do no harm, Proportionality, Nondiscrimination, Sustainability, Human determination, and Transparency (p. 31-32).

AI Systems Design: Problem Scoping

- Learners are expected to be able to understand the importance of 'AI problem scoping' as the starting point for AI innovation. They are also expected to acquire the knowledge and project-planning skills needed in order to conceptualize and construct an AI system (p. 35).

Community Connections

Community connections are suggestions on how facilitators can tailor the activity to best suit the community where the activity is being delivered.

The design of this activity procedure is done to generally connect STEM concepts to Indigenous cultural and land-based practices. Adjustments to the activity should be made by facilitators, in conjunction with Elders and Knowledge Keepers in the local community, to more thoroughly connect the teachings to local communities. Suggestions have been added throughout the activity to help facilitate connections to the community.

This activity can be complemented by inviting an Elder to talk about traditional methods of assessing and using climate data to inform community decisions.

Activity Procedure

To Do in Advance

SECTION	PREPARATION

General	• **Think ahead and be ready to adapt:**
	  ◦ Determine your **delivery method** and leverage ideas from the delivery recommendations and adaptations sections.
	  ◦ While **estimated times** are provided, it will be helpful to think about how much time you would like to spend on different activities and discussions.
	  ◦ While **group sizes** (individual, pairs, groups) are suggested, many activities are flexible for whatever will work in your classroom.
	• **Prepare for the content:**
	  ◦ Have **answers in mind** to share with participants for the various reflection questions asked.
	  ◦ Examine the provided materials to determine if they are **suitable** for your participants.
	• **Equipment:**
	  ◦ Ensure device, screen and projector are set up.

Section 1: My Climate App	• Print enough My Climate App Template (*Appendix C*) pages and prepare writing utensils for each group of 3-4 participants.

SECTION	PREPARATION
Section 2: App Expo	• Ensure there is enough space for participants to navigate from table to table and comfortably have discussions in small groups.
Section 3: Data Dash	• Review the Data Dash! Game Rules (*Appendix C*) and ensure you feel comfortable explaining the game to participants. • Print enough Data Dash! Game Boards and Data Dash! Reference Guides (*Appendix C*) for each group of 3-4 participants. • Prepare two dice, 3-4 player tokens (*Appendix C*) and 40 data tokens (20 of each colour) (*Appendix C*) for each group of 3-4 participants.

Opening Hook

1. Display the Climate Citizens Activity Slide Deck. Explain to participants that they will be exploring **data and climate** today.
2. Using Slides 2-5 from the Climate Citizens Activity Slide Deck, discuss data with participants.
3. Ask participants what type of information we record about weather and climate (Slide 6).
    a. *Possible answers: temperature, elevation, precipitation, wind speed, pressure, humidity, etc.*
4. Using Slides 7-8 from the Climate Citizens Activity Slide Deck, introduce **climate data and climate change**. Introduce the idea that **artificial intelligence (AI)** can help scientists analyze climate data.
5. Introduce AI on Slide 9 of the Climate Citizens Activity Slide Deck– ask if participants can explain what it is.
    a. **Artificial Intelligence** is the study of creating computer programs that can mimic different parts of human intelligence. This area of study

focuses on recreating human abilities that are normally almost impossible for computers, such as decision-making, speech recognition, or translating languages.

   b. You can think of AI as a set of constantly adjusting algorithms. Instead of focusing on one goal, it can change its "purpose" to do different things!

6. Briefly explain **machine learning** to participants using Slide 10 of the Climate Citizens Activity Slide Deck.
   a. A **machine learning algorithm** learns from the data it is given. The more data it has, the better the AI.
7. Ask participants if they think AI impacts the environment. Go through Slide 11 of the Climate Citizens Activity Slide Deck with participants and discuss the main concerns around AI and the environment.
   a. The more data being processed, the larger the environmental impact!

Section 1: My Climate App

1. Divide participants into groups of 3 or 4. Explain to participants that they will now roleplay as entrepreneurs, someone who starts or owns a business, and will create an idea for a new climate app.
2. Discuss the two examples on Slides 12 and 13 of the Climate Citizens Activity Slide Deck.
   a. The Weather Network app uses an AI ChatBot to help answer questions about the weather.
   b. The SIKU app is a community based climate app that provides weather information. It also works with other organizations to provide sea ice data and Indigenous words for parts of the environment and climate.
3. Describe the engineering design process on Slide 14 of the Climate Citizens Activity Slide Deck to participants and summarize the steps of the cycle. They will work through this process to design their app.
4. Use the prompts on Slide 15 of the Climate Citizens Activity Slide Deck to help participants brainstorm ideas and guide them through the design process.

5. When participants are ready, distribute the My Climate App Template (*Appendix C*) and writing utensils to each group.
6. Give participants time to design their app and support participants as needed.

Section 2: App Expo

1. Use Slide 14 of the Climate Citizens Activity Slide Deck to explain to participants that they will now take part in a mock technology expo to get feedback on their ideas.
2. Explain the two roles and ask participants to decide who will take each role.
3. Give participants time to explore and discuss each other's ideas.
    a. Depending on the group and the needs of your participants, have participants switch roles halfway through the expo so they have a chance to give feedback and present ideas.
4. When participants are ready and discussions are slowing down, announce that "The Canadian Government has just announced a Climate Technology grant and that every group now has funding to start building their app!"

Section 3: Data Dash

1. Explain to participants that now that they have designed their app and secured funding, they will now play a game to collect the data they need to bring their app to life.
2. Distribute the materials (*Appendix C*) for the game to each group. Ask participants to place their player tokens in the centre of the game board on the "Train AI" space.
3. Explain the rules of the game to participants. Address participants as they have questions.
4. Give participants time to play the game and attempt to train the AI for their app.
5. When most participants have finished the game, bring participants back together to debrief.

Reflection & Debrief

1. Ask participants the following reflection questions.
    a. What were the ideas you came up with?
    b. What kind of feedback did you receive? Are there any changes you would make to your app?
    c. What are some of the challenges an AI app developer might face?
    d. What does it mean to train AI and what are the benefits of doing that? What happens if AI is trained with poor or irrelevant data?
2. Discuss the different careers listed in *Appendix A: Career & Mentor Connections*.
3. Encourage participants to share their learnings from this activity with their friends and family.

Delivery Adaptations

How might you adapt the time, space, materials, group sizes, or instructions to make this activity more approachable or more challenging? **Modifications** are ways to make the activity more accessible, **extensions** are ways to make the activity last longer or more challenging.

Modifications

SECTION 1: MY CLIMATE APP

- Generate ideas as a group and have participants choose one of the ideas to help participants get started.
- Provide different pairs of datasets to help participants with ideation. Examples could include:
    - Temperature and precipitation
    - Average temperature and average temperature with wind chill
    - Humidity level and precipitation

SECTION 3: DATA DASH

- Invite participant volunteers to play a round with facilitators to demonstrate how the game works.
- Remove the rule that increases the required roll after each failed training attempt.
    - Alternatively, lower the required roll to win to 10 or 11.

Extensions

SECTION 1: MY CLIMATE APP

- Ask participants to design a catchy slogan for their app.
- Challenge participants to incorporate a third type of dataset into their app.
- Challenge participants to design a simple flowchart that describes how the app makes decisions using the data.

SECTION 3: DATA DASH

- Ask participants to calculate the odds of training the AI on the first attempt. (1/36). Participants can also try to calculate:
    - How many sets of data they need to guarantee a win on the first try (lowest roll is 2, 10 sets of data)
    - The odds of rolling a 6, 7, or 8 (5/36 + 6/36 + 5/36 = 16/36 or 4/9)

References & Gratitude

BYJU's. (n.d.). Types of data in statistics. byjus.com/maths/types-of-data-in-statistics/

Delaware Climate Projections Portal. (n.d.). Delaware climate terms and definitions. cema.udel.edu/applications/declimateprojections/resources/climate-terms.php

Heikkilä, M. (2023, December 5). AI's carbon footprint is bigger than you think. MIT Technology Review. technologyreview.com/2023/12/05/1084417/ais-carbon-footprint-is-bigger-than-you-think/

IBM. (2023). What is artificial intelligence (AI)? ibm.com/topics/artificial-intelligence

NASA. (n.d.). What types of data do scientists use to study climate? science.nasa.gov/climate-change/faq/what-kinds-of-data-do-scientists-use-to-study-climate/

National Geographic. (n.d.). All about climate. education.nationalgeographic.org/resource/all-about-climate/

Schwing, E. (2023). As sea ice breaks up, AI is starting to predict where sea ice will go. Scientific American. scientificamerican.com/podcast/episode/as-arctic-sea-ice-breaks-up-ai-is-starting-to-predict-where-the-ice-will-go/

Thomas, S. (2022, February 17). Discrete vs continuous variables: Differences explained. Outlier. articles.outlier.org/discrete-vs-continuous-variables

United Nations Educational, Scientific and Cultural Organization. (2024). UNESCO AI framework: Competency levels. unesdoc.unesco.org/ark:/48223/pf0000391105

Appendices

Appendix A: Career & Mentor Connections

APP DEVELOPER

- An app developer is a computer programmer whose work includes creating, testing and programming apps for computers, mobile phones, and tablets. Developers typically work in teams, and think of ideas for the general public, or for a specific customer need. Developers may work closely with graphic designers and data scientists.

CLIMATOLOGIST

- A climatologist studies the Earth's climate by analyzing climate patterns and determining the impact these patterns have on Earth over a long period of time.

METEOROLOGIST

- A meteorologist specializes in studying the weather on a short time scale and predict future forecasts.

Appendix B: Background Information

CLIMATE DATA

Climate and weather are both about the conditions of the air around us, but they are not the same. Weather describes the day-to-day changes in temperature, rain, wind, and sunshine that we experience. For example, it might be sunny today and rainy tomorrow. Climate, on the other hand, is the average weather in a place over a long period, like 30 years or more. It tells us what kind of weather a place usually has, like how deserts are generally hot and dry, while the Arctic is cold and snowy.

Climate data refers to the collected information about a climate. Scientists also include important information about the instruments used to collect the data to help climate scientists around the world standardize data to help make global predictions.

ARTIFICIAL INTELLIGENCE (AI)

Artificial intelligence (AI) is a branch of Computer Science that deals with a machine's ability to simulate intelligent behaviour. This includes cognitive functions we associate with human minds, such as perceiving, reasoning, learning and adapting.

AI is becoming increasingly vital in our lives. From digital assistants, GPS navigation, and autonomous vehicles to tools like Siri/Google Home and generative AI tools (e.g., OpenAI's Chat GPT), its impact on our daily lives is growing. AI plays a crucial role in various aspects of work, enhancing efficiency, and taking on hazardous or monotonous tasks. As AI applications grow, discussions on AI ethics and responsible practices are increasingly important.

AI and Climate Data

AI allows us to process large amounts of data much faster and efficiently than humans can. Due to its efficiency and ability, scientists are exploring ways to model patterns and trends about our future climate using larger amounts of data than before.

Climate change is causing dramatic changes across the globe, especially in the Arctic when it comes to sea ice levels and weather patterns. As a result, historical data can no longer be used accurately to predict conditions. As a result, scientists have begun to rely upon AI and machine learning (ML) to help predict sea ice forecasts and use that to inform whether ships can safely pass through routes at different times of the year.

Using data and forecasts from previous models, along with images collected from sensors on ships, scientists put together a data collection of sea ice forecasts over time. With the help of this data, they created a machine-learning model that could generate daily and seven day sea ice forecast predictions.

Appendix C: Additional Resources

GENERAL

Activity Slide Deck

- Climate Citizens Activity Slide Deck

SECTION 1: MY CLIMATE APP

Activity Page(s)

- My Climate App Template *(refer below)*

SECTION 3: DATA DASH

Supporting Resources

- Data Dash Rules *(refer below)*

Activity Page

- Data Dash Game Board *(refer below)*
- Data Dash Reference Guide *(refer below)*
- Data Dash Printable Tokens (Data and Player) *(refer below)*

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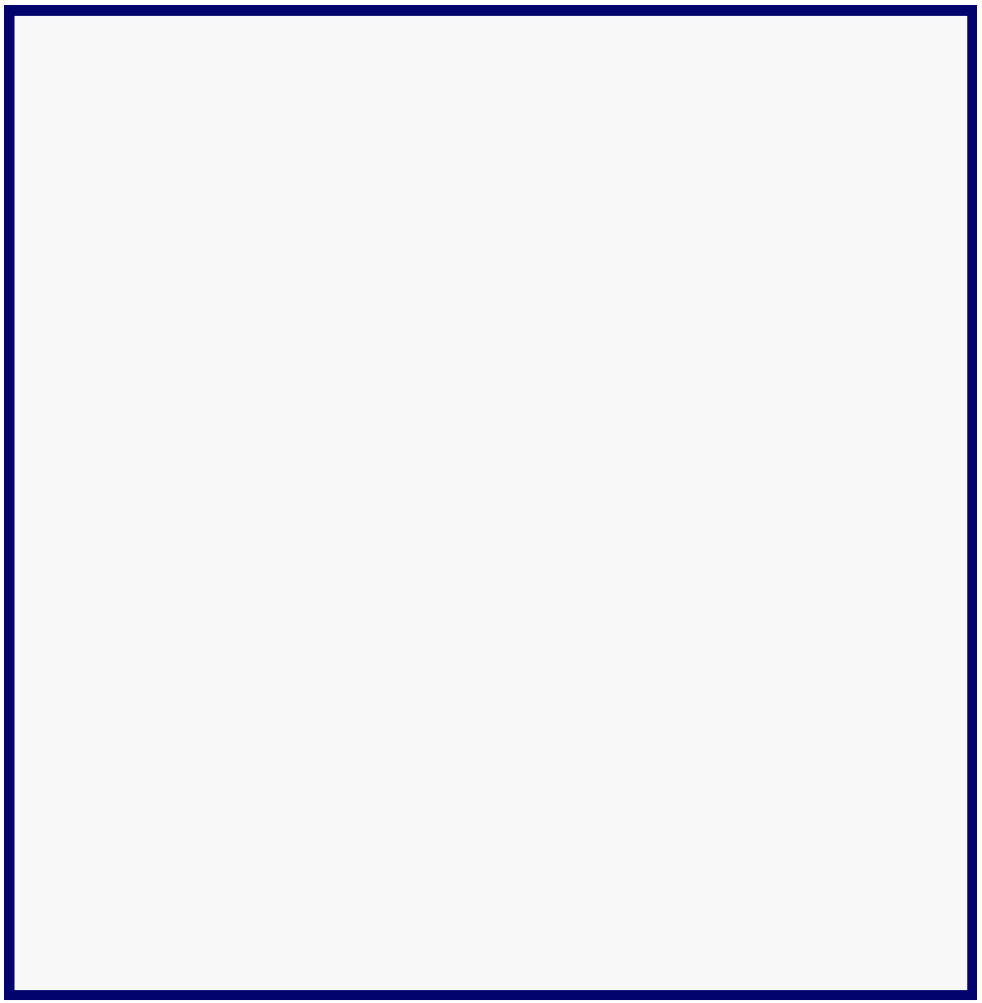
My Climate App Template

My Climate App

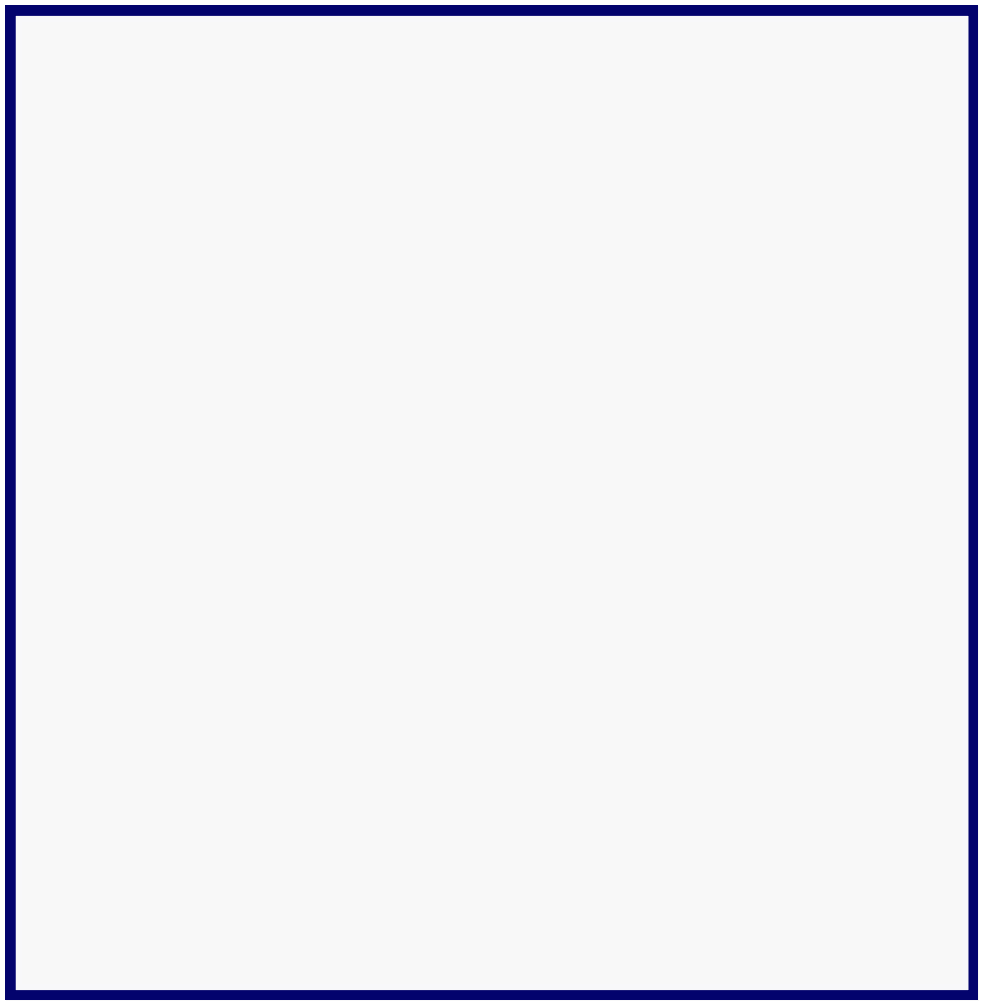
App Title: _____

Dataset A: _____

Dataset B: _____



Home Screen



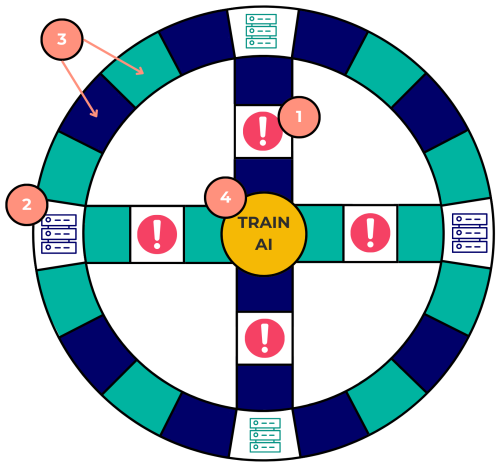
Sample Screen

Data Dash! Game Rules

The Game Objective

The objective of the game is to move around the board and collect training data as a team. Once you've collected enough data, the team can attempt to train their AI for their new app! Successfully training the AI results in a win for your team! **Players start in the centre** on the Train AI space.

The Game Board



Taking a Turn

The player who last had a birthday goes first. On your turn you **roll one die** and move that many spaces. You can **choose which direction to move** in but **cannot change directions** in the middle of your turn. Depending on which kind of space you land on you will do one of the following actions listed below:

1. **Problem Space:** If you land on one of these spaces, you roll 1 die and complete the action listed on the reference page based on the number rolled.
2. **Asset Space:** If you land on one of these spaces, you roll 1 die and complete the action listed on the reference page based on the number rolled.
3. **Data Spaces (2 colours/shades):** If you land on one of these spaces, you collect 1 data token of the matching colour/shade.
4. **AI Training Space:** You can land on or pass over this space to train your AI. If you do train your AI this turn, your turn ends afterwards.

After completing one of the actions listed above, your turn ends and the player to your left goes next.

Training the AI System

To train the AI system, the player determines **how many matching sets of 3 data tokens** the team has collected. A matching set consists of **3 data tokens of the same colour/shade**. The player then goes through the following steps:

1. **Roll two dice** and observe the result.
2. Take the **total number of both dice** and **add** the **number of matching data sets** the team has collected.
3. The player now does **one** of the following actions:
    a. If the number is **higher or equal to 12** then the team has successfully trained their AI and won the game!
    b. If the number is **lower than 12** then training has failed and the team adds 1 to the number needed to train the AI on the next attempt.
        i. This can be tracked on the reference page and can not go past 17.

Note: The instructions above assume that the **team is training the AI for the first time**. For other attempts the number needed is the number tracked on the reference page.

Examples for Game Play

EXAMPLE 1 - PLAYER 1 TRAINS

Player 1 travels to the Train AI space. The team has collected **7 blue data tokens** and **9 green data tokens.** They need to **roll a 12** to train their AI and win.

Player 1 rolls a 4 and a 2. They get a bonus of **+2** for their 2 sets of 3 blue tokens and a bonus of **+3** for their 3 sets of 3 green tokens.

Dice Roll	Blue Data Bonus	Green Data Bonus	Total Roll
4 and 2 = 6	+2	+3	6+2+3 = 11

Player 1 **fails to train the AI** and increases the **number needed to train the AI by 1**. The team now needs to **roll 13 next time** they train.

EXAMPLE 2 - PLAYER 2 TRAINS

Player 2 now travels to the Train AI space. The team has collected **7 blue data tokens** and **9 green data tokens.** They need to now **roll a 13** to train their AI and win.

Player 2 rolls a 5 and a 3. They still get a bonus of **+2** for their 2 sets of 3 blue tokens and a bonus of **+3** for their 3 sets of 3 green tokens.

Dice Roll	Blue Data Bonus	Green Data Bonus	Total Roll
5 and 3 = 8	+2	+3	8+2+3 = 13

Player 2 **successfully trains the AI** and the team wins!

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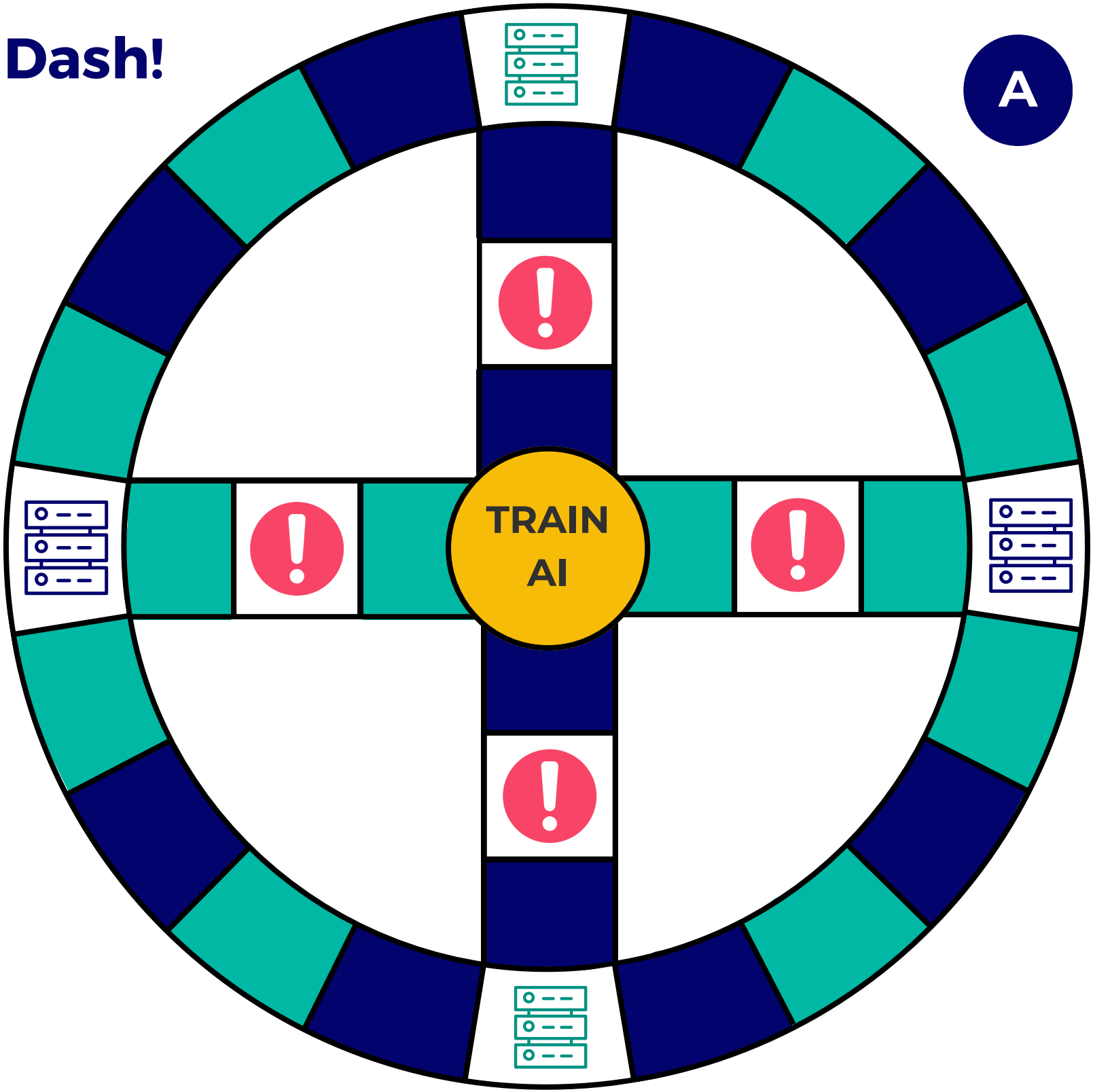
Data Dash Game Board

Data Dash!

A

B



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Data Dash Reference Guide

Data Dash! Reference Guide

	Effect
1 or 2	One of your servers has crashed. **Lose your next turn** while it is repaired.
3, 4 or 5	One of your hard drives has become corrupted. Have it restored and **lose a turn** OR **discard one data token** you've collected.
6	Your funders want the app rolled out tomorrow! **Move to the centre, you must train your AI this turn**.

	Effect
1 or 2	Your software engineer has improved your data storage! The **next time you collect a data token, collect two instead**.
3, 4 or 5	You've been gifted an extra server! **Collect one data token of your choice**.
6	An open source Canadian climate dataset has been released publicly! **Collect three data tokens of your choice.**

Required roll for successful training

12	13	14	15	16	17

***Remember to increase by 1 after each unsuccessful training attempt!**

****Add +1 to your roll for every 3 datasets you've collected.**

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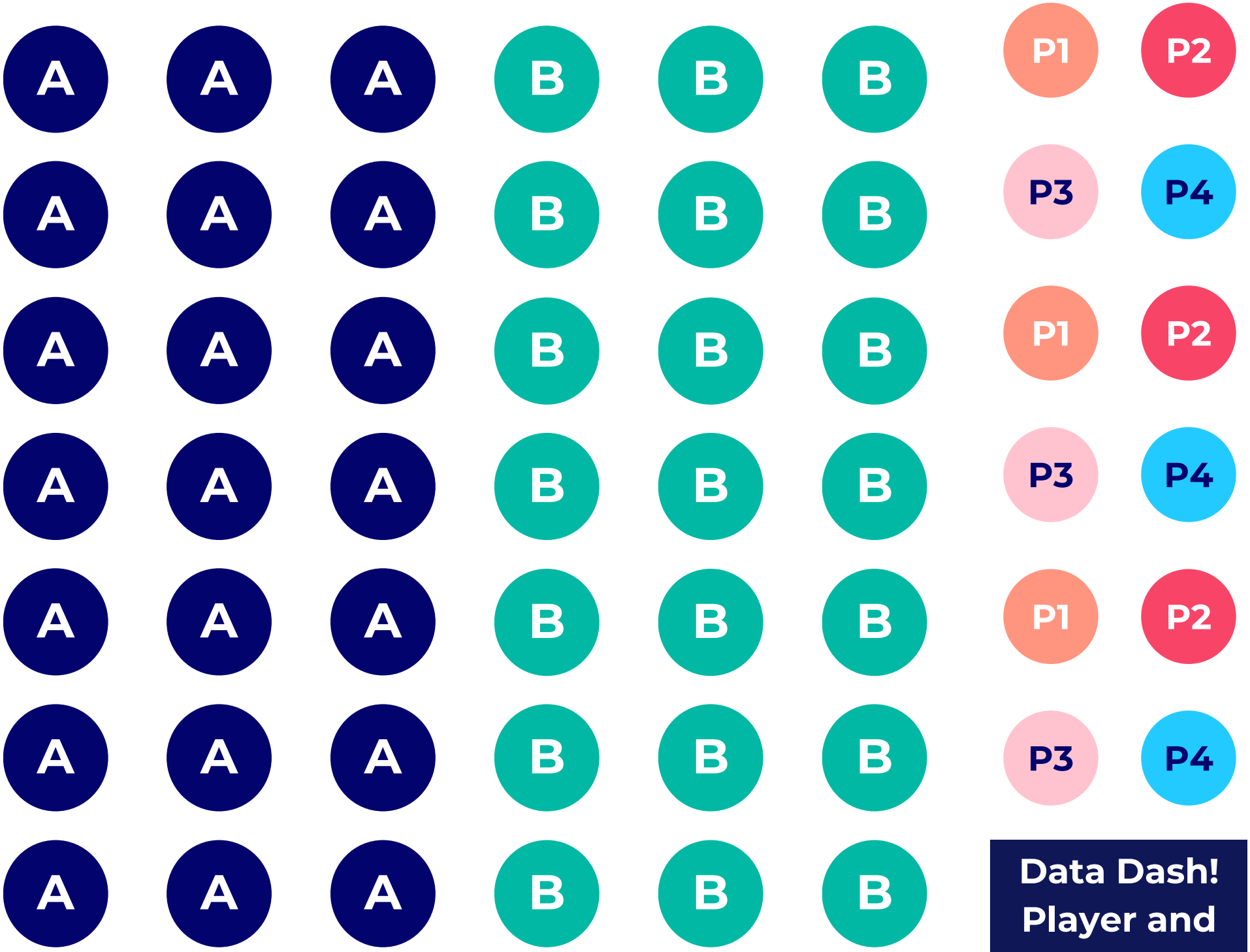
Printable Tokens (Player + Data)


A A A B B B
A A A B B B
A A A B B B
A A A B B B
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A A A B B B
A A A B B B
P1 P2
P3 P4
P1 P2
P3 P4
P1 P2
P3 P4
Data Dash!
Player and
Data tokens