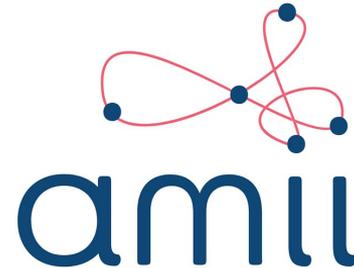




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Enhancing Teachers' AI Literacy:
Learnings from Amii's AI in K-12
Pilot Program





Enhancing Teachers' AI Literacy: *Learnings from Amii's AI in K-12 Pilot Program*

March 20, 2024





ALBERTA MACHINE INTELLIGENCE INSTITUTE

“Inspiring world-changing machine intelligence – for good and for all.”



We're one of Canada's three National AI Institutes

First launched in 2017, the Pan-Canadian AI Strategy has now invested **\$568 million** to establish Canada as a destination for research and commercialization.

- Propel leading-edge AI research
- Accelerate AI commercialization
- Attract, retain and develop world-class AI talent
- Advance the adoption of AI standards
- Enhance training and knowledge mobilization
- Provide research infrastructure

ami

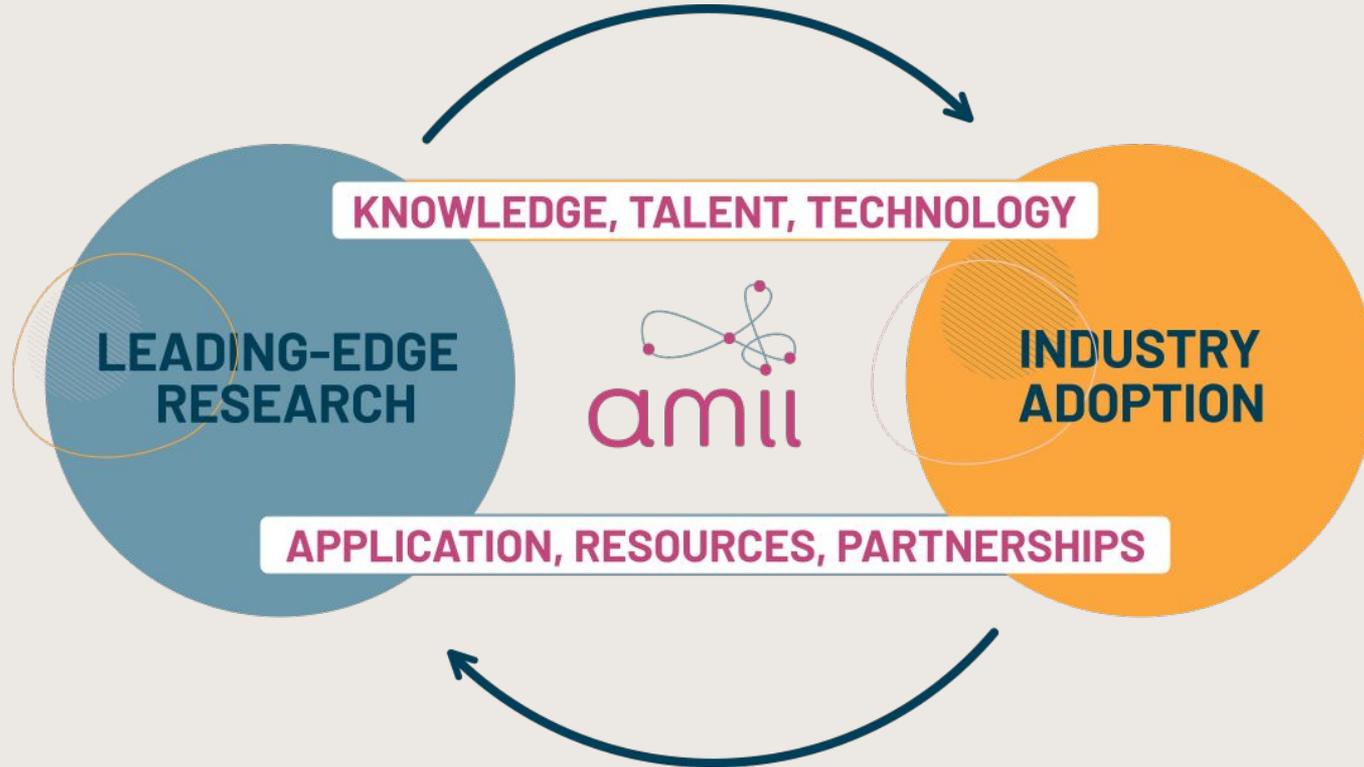


Mila



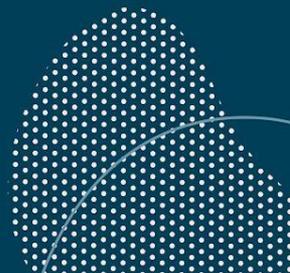
VECTOR
INSTITUTE

We support **leading-edge research** in AI and translate scientific advancement into **industry adoption**





What are AI and ML?



What is Artificial Intelligence?

Artificial
Intelligence

What is Machine Learning?

Artificial
Intelligence

Machine
Learning

What is Deep Learning?

Artificial
Intelligence

Machine
Learning

Deep
Learning

Key Terminology

Artificial Intelligence

Enabling computers to act intelligent by mimicking human behaviour.

Machine Learning

Using data, algorithms and computation to enable machines to learn.

Deep Learning

Subclass of ML that relies on massive computational power and amounts of data. **"Black-boxes."**

FLIPPER SAYS THIS IS YOUR **TAKE AWAY!**

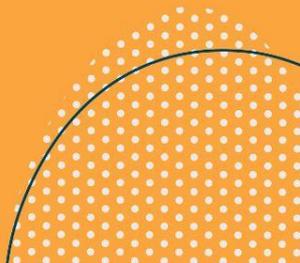
The overlap in terminology is messy
and can be difficult to distinguish;
ultimately what matters is that you
know:

DATA + COMPUTATION = LEARNING



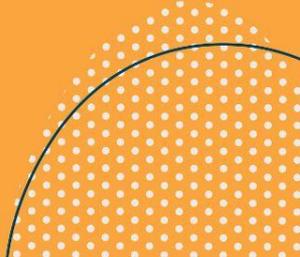


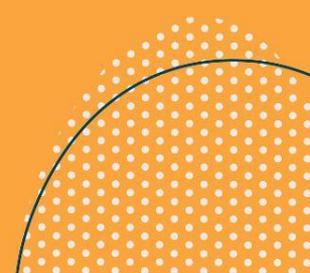
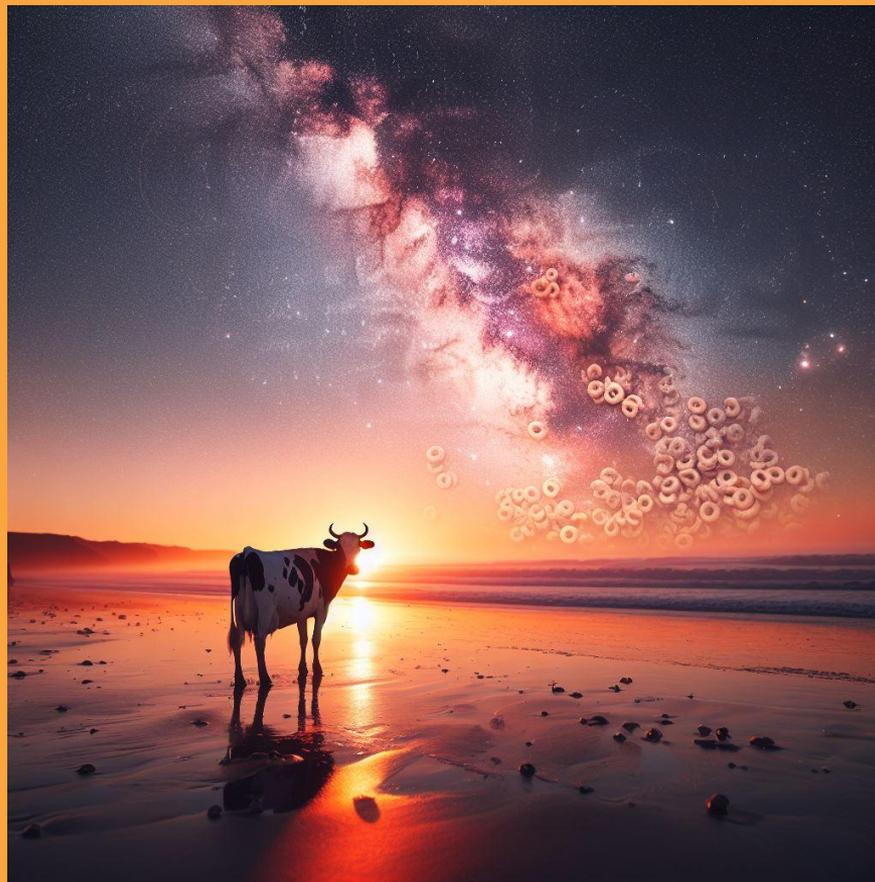
***Generative AI: Algorithms that
create content including images,
text, code, and videos***

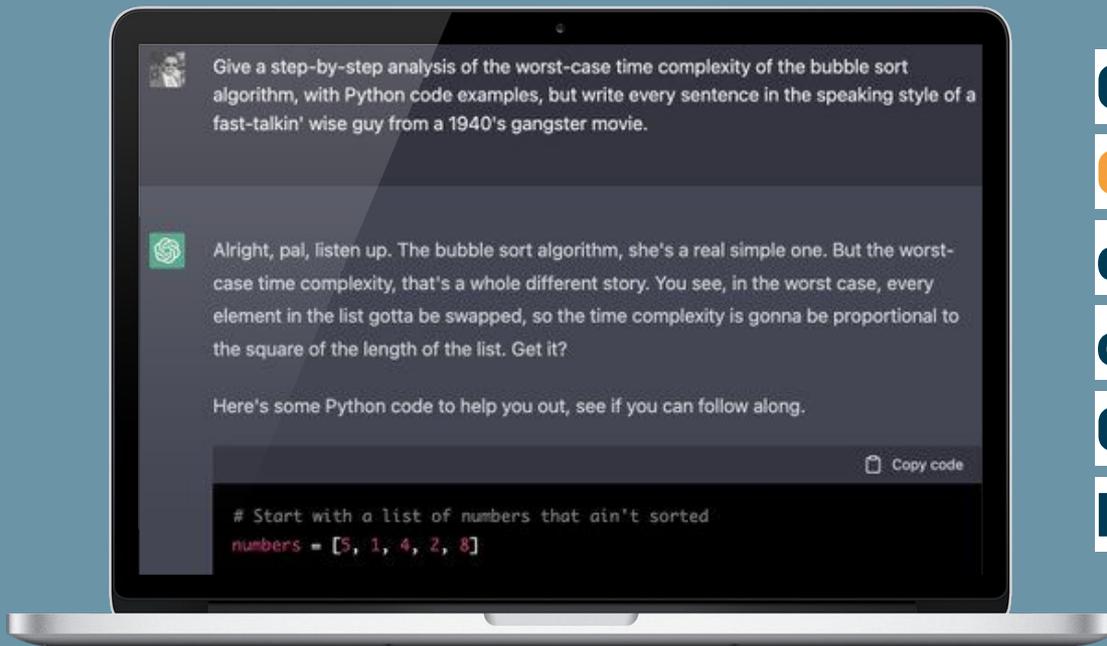




***“A beautiful sunset with a cow standing
on the beach and the milky way galaxy
made out of cheerios in the sky”***







OpenAI announced
ChatGPT, a
dialogue-based AI
chat interface for its
GPT family of large
language models

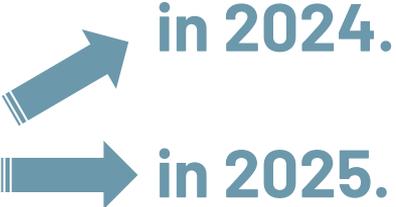
ChatGPT is simply very good on connecting words

The Edmonton Oilers will win the Stanley Cup



ChatGPT is simply very good on connecting words

The Edmonton Oilers will win the Stanley Cup



in 2024.

in 2025.

ChatGPT is simply very good on connecting words

The Edmonton Oilers will win the Stanley Cup



in 2024.

in 2025.

never.

ChatGPT is simply very good on connecting **sentences**

The Edmonton Oilers will win the Stanley Cup in 2024.



With a rocky start to the season, after the Heritage Classic...



ChatGPT is simply very good on connecting

paragraphs

The Edmonton Oilers will win the Stanley Cup in 2024. With

a rocky start to the season, after the Heritage Classic

the Oilers go on a 10 game winning streak and win the cup.

Next season in the NHL they added a new rule that all goal

celebrations had to involve confetti to improve ratings...

ChatGPT is simply very good on connecting

texts

model can show a relationship between variables, it does not imply in the model, could be influencing the relationship.

least-squares-regression/least-squares-regression_en.html



Figure 1
simulation:

clicking the small black down arrow, as shown in Figure 1.

"Temperature(F) vs. Latitude", change the bias "a" and weight "b" by dragging on the right side of the figure.

the dataset by clicking the "My Line". This will show you the best fit line and the result with the best fit line, provided by the simulation as "Best

on Coefficient" for this dataset.

other datasets and compare their correlation coefficients.

the k-NN algorithm used for classification. Now think about the how can you combine the bias of distance metrics (as a metric of loss) and to predict numbers instead of classes? Describe your method.

x1	x2	Y
1	1	10
1	2	12
1	3	15
2	2	15
2	5	25

We want to predict the value for the point (x1, x2) = (2, 4) using 4-NN algorithm

1. First, find the nearest 4 points to this point.
2. Calculate the distance between this point and the 4 nearest neighbours using the euclidean distance metric.
3. Let's say the 4 nearest neighbours are points p1, p2, p3, p4 having y1, y2, y3, y4 respectively. Our goal is to aggregate these as our prediction.
 - a. One way is to get the average of all y1, y2, y3, y4 as the prediction. In this case our prediction = (y1 + y2 + y3 + y4) / 4. Calculate this prediction.
 - b. Another way is to weigh each basis on its distance from the point. The closer the neighbour is, the more weight we give it to the corresponding y. Use the following formula and calculate the prediction.

$$\text{Prediction} = \frac{(1/(d1)) * y1 + (1/(d2)) * y2 + (1/(d3)) * y3 + (1/(d4)) * y4}{(1/(d1)) + (1/(d2)) + (1/(d3)) + (1/(d4))}$$
4. Which prediction is more accurate?

Optional Activity:

In the course material, you have seen the complete formulation for least square error. One note there is the assumption that X'X is invertible. What does that mean? When is this matrix not invertible?

Look at the following source for more information: <https://textbooks.math.gatech.edu/la/least-squares.html>

Alternative activity: <https://setosa.io/ev/ordinary-least-squares-regression/>

The Case Study

Executive Summary

Inventory planning is one of the most challenging problems in today's supply chain. Inaccurate demand forecasting can result in the loss of millions of dollars worth of sales for large retailers like Walmart. Using intelligent machine learning solutions, retailers can optimize their inventory management by predicting demand for their products in the future. This leads to increasing revenue, mitigating risks associated with unexpected shortages, and reducing wastage due to overstocking of goods.

This case study discusses how Walmart, the biggest retailer globally, leverages the massive amount of data it has collected over the previous years to design a smart demand forecasting solution. This innovative, fully-scalable machine learning platform developed by Walmart has delivered significant improvements in forecasting accuracy, creating a positive business impact for the company over the past two years. It is now being utilized in several key global markets, forecasting demand for over 100M store-item combinations.

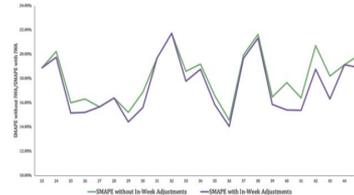


Figure 2: IMA Algorithms over 40 bps improvement per week in the forecast accuracy metric. Source: Weekly Demand Sensing at Walmart (Walmart Global Tech, 2021)

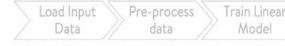


Figure 3: Results of IMA Algorithm BPS gains per Product Categories - e.g. peaches (first bar), pumpkins seasonal (last bar). Source: Weekly Demand Sensing at Walmart (Walmart Global Tech, 2021)

The initial success of the forecasting algorithms prompted Walmart to expand the use of the system to more departments. By mid-2020, all of Walmart's key departments in the US adopted this forecasting solution. In addition, the success in the US market led to Walmart extending the forecasting models to its international markets. Over a period of two years, Walmart introduced the same system to Canada, Mexico, and the United Kingdom. As a result, the forecasting solution delivered about -650 bps of accuracy improvements for these international markets, which is even higher than the improvements observed in the US. Thus, Walmart is planning to further extend this system to other international supply chain markets in the future.

With the help of the AI-driven solution, Walmart removed an appropriate amount of previously established demand management practices that were degrading its forecast quality. By utilizing the large amounts of data at their disposal, they optimized their operations with a comparatively fair, logical, and data-driven decision methodology. In addition to boosting the quality of their demand forecasts, the smart forecasting system provided - to their demand managers and other stakeholders - deeper insights not available previously. Because the solution was designed by incorporating feedback from the business stakeholders and management, they were able to visualize the reasoning behind the predictions and view several key metrics driven by the forecast. This

weekday demands. However, to overcome the limitation of this algorithm not incorporating real-time data, the company developed the In-Week Adjustment (IWA) algorithm. This lightweight linear model provided updated weekday forecasts. The IWA factored in replenishment rule forecasts, and used weekend sales along with the original forecast as independent variables. The IWA-managed outliers and deployed separate models for under-selling and over-selling items, offering inventory based on current stock and projected demand.



- Load historical weekly demand forecasts for target categories
- Load 52 weeks of store-item-week sales
- Calculate each item's daily sales using robust estimators
- Remove all store-item-week combinations which may not need adjustments
- For each item, select the store-item-week where it is over-selling or under-selling
- Train a linear model to predict demand as: $\text{demand} = \phi^T \alpha + \phi^T \alpha_{\text{week}}$

Figure 1: Model Implementation. Source: Weekly Demand Sensing at Walmart (Walmart Global Tech, 2021)

Deployment & Acceptance

To integrate their enhanced forecasting algorithms, Walmart began with the West and Product U.S. stores, which had struggled with inaccurate forecasts. This strategy was dual-purposed: to test the solution's robustness due to the complex demand influences. Besides better prediction accuracy, the solution needed to be a design platform was built to expand compute power or storage capacity. A multi-tenant architecture was developed to allow for quick solution expansion to other markets without raising maintenance costs. A comprehensive backtesting process evaluated the models' performance, provided stakeholders for feedback, and ensured that the algorithms capitalized on Walmart's deep supply

Outcome

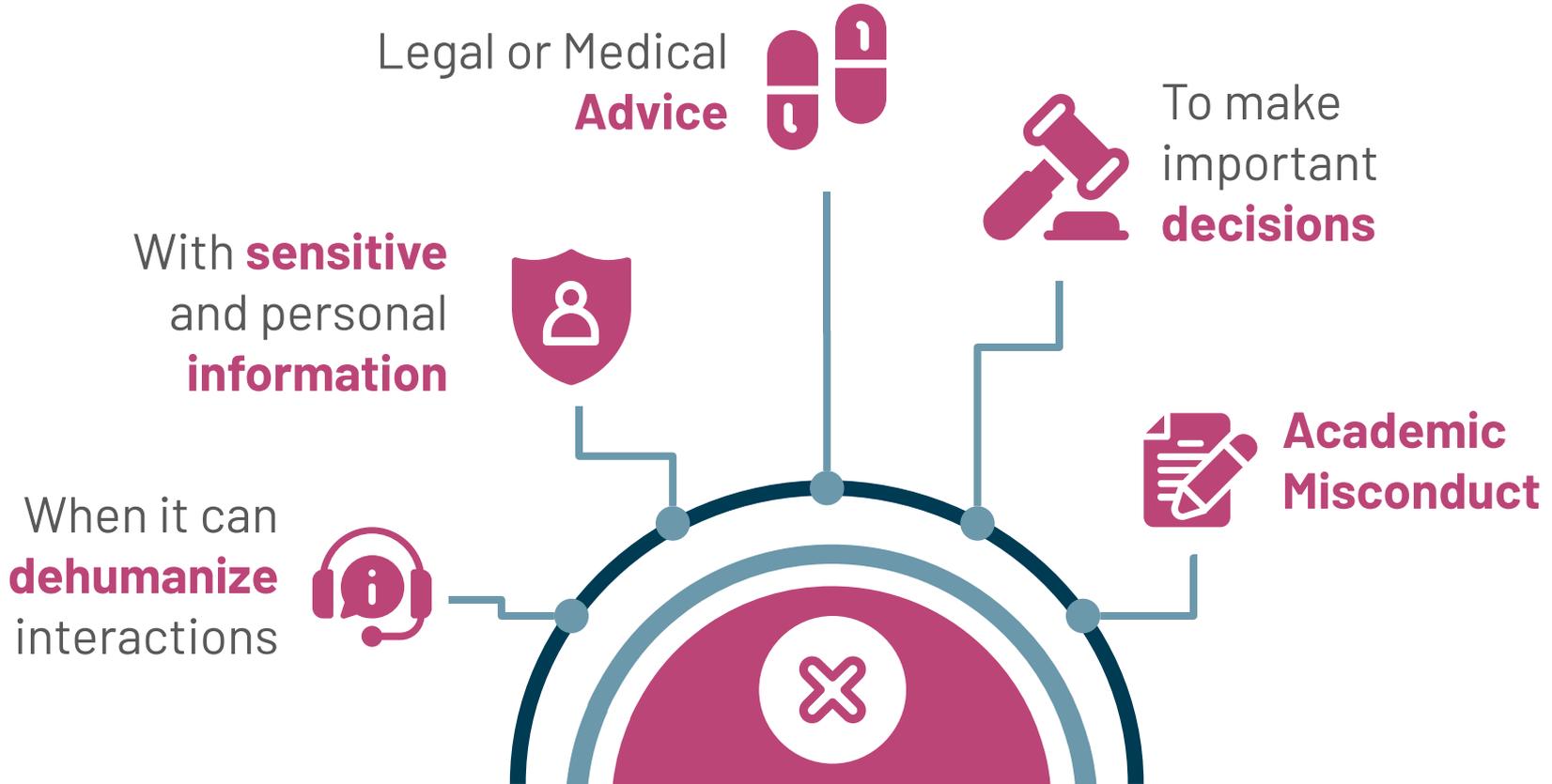
The developed IMA algorithm showed tremendous promise as they witnessed about -200 bps in the forecast accuracy. Illustrated in Figure 2, Figure 3 shows how the gains were not only on products, instead, they observed these improvements for about 70% of product categories, which is remarkable. If we consider Walmart's \$20 billion dollars worth of sales each year, the 2% improvement accuracy would be estimated as tens of billions of dollars of additional profit. Therefore, the improvements were very significant for the company.

basis points (bps)

When can you use ChatGPT?



When should you **not** use ChatGPT?



Ethical Concerns for AI in Education

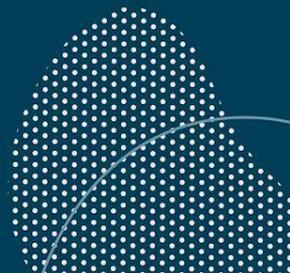
- Biased AI systems
- Teacher autonomy and teacher moral agency
- Student-teacher relationship
- Rubber Stamp phenomenon
- AI-human value alignment
- Cognitive atrophy
- Consent
- Data privacy

CONCLUSION

- Many **new possibilities and questions** with the introduction of new tools
 - **How might generative AI impact teaching and learning?**
 - **What ethical considerations do we need to be aware of as teachers and educational leaders?**



Learnings from Amii's AI in K-12 Pilot



Amii's High Level Program Goal

*K-12 Students will
have a strong AI
and ML foundation
as they move
towards
post-secondary*

How do we get there?

Our program centers **teachers** so
they can better support their
students learning about AI and
ML.

What did we do?

- **May-June 2023**
 - Stakeholder engagement sessions with pilot teachers across three school authorities
- **June-September 2023**
 - Resource build
 - Four Learning Kits
 - AI 101 for Educators Workshop
- **August-September 2023**
 - PD workshops for pilot teachers
- **November 2023**
 - Midpoint feedback
- **January 2024**
 - Final feedback & conclusion of pilot

What did we build?

Four Learning Kits:

1. **Harnessing the Potential of ChatGPT:** Designed to assist teachers with the necessary background knowledge of Large Language Models such as ChatGPT and help students utilize ChatGPT responsibly.
2. **AI in the Real World:** Focuses on the impacts of AI on various aspects of society, helping students to think critically not only about AI but technology more generally.
3. **Careers Reimagined:** Designed to help students understand the profound impact AI has on diverse industries and to recognize the wide range of career pathways it opens up.
4. **Computer Science in the Age of AI:** Focuses on illuminating the AI-related outcomes in the Computer Science Program of Studies by providing projects and learning activities for students.



Learning Kit Stats

What's in a learning kit?

- **20** lesson plans/learning activities
- **6** slide decks
- **19** student worksheets
- **9** Assessment resources including rubrics and assignment sheets
- **27** other resources including videos, instructional guides, voice overs, and case studies

300+ pages/slides, 81 items

Indicators of Success

How did we measure success of the pilot?

- 1. Number of teachers trained**
 - 78 teachers in the pilot
- 2. Number of participant schools**
 - 21 schools across 3 school authorities
- 3. Number of students impacted**
 - 5200*

Next Steps

- Continue to add to high school learning kits
- Amii guest speakers in classrooms in 2024
- PD evenings for teachers hosted by Amii (twice annually)
- K-9 pilot will commence in April 2024!
- Exploration of partnerships with more school authorities and education-focused organizations

Check out the
Learning Kits for
yourself!



Let's Connect!



Jill Kowalchuk, M.Ed, PhD Student
K-12 Education Advisor

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