



Tomorrow's Doctors, Tomorrow's Cures®

# Building AI Partnerships Across Medicine, Industry, and Government

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Learn

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Serve

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Lead

**Sept. 24, 2024**



Association of  
American Medical Colleges



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Illinois College of Medicine



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Lead

# Building AI Partnerships Across Medicine, Industry, and Government

Jamie Fairclough, PhD, MPH, MS  
Associate Dean for Research, Assessment, & Evaluation  
Data Science & Engineering Unit Director  
Roseman University of Health Sciences | College of Medicine

September 24, 2024



Association of  
American Medical Colleges

# Why Establish AI Partnerships?

1. **Accelerate Innovation** in medical imaging and diagnostics, clinical decision support systems, drug discovery, and personalized care.
2. **Leverage Resources** from diverse sectors to enhance teaching and learning, research, and clinical outcomes.
3. **Improve Patient Care and Population Health Outcomes** by integrating AI into healthcare systems and public health initiatives.

# Benefits of AI Collaborations

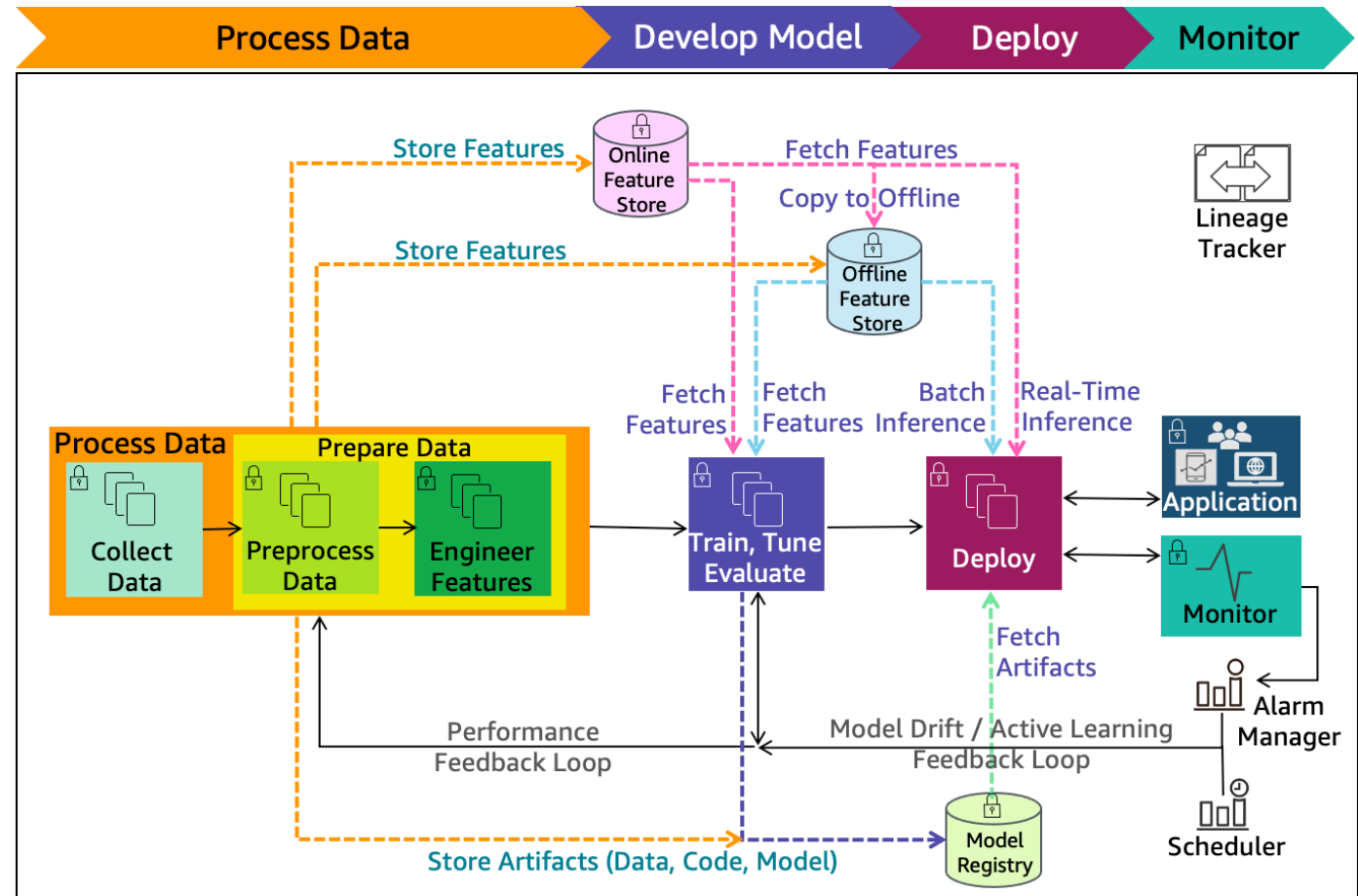
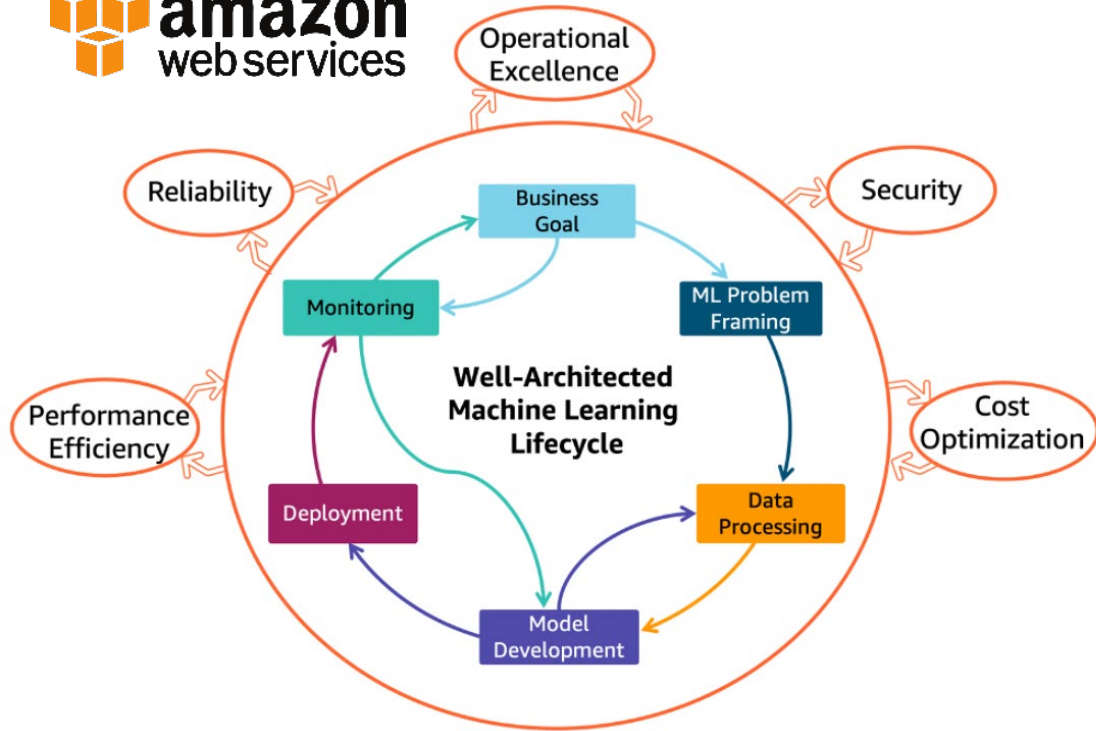
- **Enhanced Research Capacity:** Access to AI tools and datasets for cutting-edge research.
- **Interdisciplinary Education:** Train future healthcare leaders in AI and data science techniques.
- **AI-Driven Solutions:** Create AI products validated through clinical trials and research.
- **Expansion:** Partner with other academic institutions and government agencies to increase capacity.
- **Public Health Impact:** Enhance disease surveillance, epidemiology, and healthcare access.



# Roseman University of Health Sciences -- College of Medicine

- **Mission:** To align students, educators, and the community in designing and delivering an inclusive and collaborative environment for innovative learning, healthcare, and research.
- RUCOM Location: Las Vegas, NV
- Private | Nonprofit | Startup Medical School

# RUCOM Cloud Provider: Amazon Web Services (AWS)



- QuickSight
  - Amazon Rekognition
  - Amazon SageMaker
  - S3
  - EFS
- 
- Amazon SageMaker** X
- Getting started
  - Studio
  - Studio Lab
  - Canvas
  - RStudio
  - TensorBoard
  - Profiler
- 
- ▼ **Admin configurations**
- Domains
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- SageMaker dashboard
  - Search
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- ▼ **JumpStart**
- Foundation models **NEW**
  - Computer vision models
  - Natural language processing models
- 
- **Governance**
  - **Ground Truth**
  - **Notebook**
  - **Processing**

MACHINE LEARNING

# Amazon SageMaker

## Build, train, and deploy machine learning models at scale

The quickest and easiest way to get ML models from idea to production.

**AWS provides in-person, hands-on cloud AI/ML training for Roseman faculty and staff.**

**New to SageMaker?**

Quick setup for a single user ⓘ  
This is perfect for first time users to try capabilities in just a few clicks.

[Set up for single user](#)

---

Advanced setup for organizations  
Customize capabilities, permissions, network, and more for your team to launch Studio.


[Set up for organizations](#)

**Documentation**

- [Getting started](#)
- [Tutorials](#)
- [Documentation](#)
- [Developer Resources](#)
- [AWS Developer Forum](#)
- [Contact us](#)

### How it works

**What is Amazon SageMaker?**  
Amazon SageMaker provides machine learning (ML) capabilities for data scientists and developers to prepare, build, train, and deploy high-quality ML models efficiently.

 **New user onboarding guide** **NEW**  
Get started with Amazon SageMaker by completing the quick start onboarding guide.  
[Get started with SageMaker](#)

**Typical SageMaker workflow**

1. Label data





## Ready-to-use models

You must have the necessary permissions to make predictions with Ready-to-use models. Go to the [SageMaker Console](#) to enable permissions for this account if this hasn't been done already. If you don't have access to the [SageMaker Console](#), contact your administrator. [Learn more](#)

New!

### Accelerate your productivity using generative AI

Content generation, extraction, summarization, and many more tasks are easier to perform using foundation models from Amazon Bedrock and publicly available models from Amazon SageMaker JumpStart.

Get started now

- Summarize...
- Write a blog post...
- Explain...
- Brainstorm ideas...
- List key takeaways...
- Improve writing...
- Rewrite...
- Outline...
- Change tone...
- Reply to this...
- Simplify...
- Compare...
- Paraphrase...

Search use case

Last used Grid List

Can't find the right model? [Create a custom model](#)

### Generative AI using foundation models

Our content generation models can help you craft engaging narratives, articles, answer questions, and more, tailored to your needs.

Generate, extract and summarize content + Query documents

New

Powered by Amazon Bedrock and Amazon SageMaker JumpStart

## Ready-to-use models

**i** You must have the necessary permissions to make predictions with Ready-to-use models. Go to the [SageMaker Console](#) to enable permissions for this account if this hasn't been done already. If you don't have access to the [SageMaker Console](#), contact your administrator. [Learn more](#)

### Additional ready-to-use models

Our ready-to-use content extraction models can quickly distill insights from text, image, and document data.

Filter by data type:  Text  Image  Document

#### Object detection in images

Detect objects, concepts, scenes, and actions in your images.

Powered by Amazon Rekognition

#### Document queries

Extract information from structured documents such as paystubs, bank statements, W-2s, and mortgage application forms by asking questions using natural language.

Powered by Amazon Textract

#### Sentiment analysis

Detect sentiment in lines of text, which can be positive, negative, neutral, or mixed.

Powered by Amazon Comprehend

#### Entities extraction

Extract entities, which are real-world objects such as people, places, and commercial items, or units such as dates and quantities, from text.

Powered by Amazon Comprehend

#### Language detection

Determine the dominant language in text such as English, French or German.

Powered by Amazon Comprehend

#### Personal information detection

Detect personal information that could be used to identify an individual, such as addresses, bank account numbers, and phone numbers, from text.

Powered by Amazon Comprehend

#### Text detection in images

Detect text in your images.

Powered by Amazon Rekognition

#### Expense analysis

Extract information from invoices and receipts, such as date, number, item prices, total amount, and payment terms.

Powered by Amazon Textract

Previewing up to the first 100 rows of NIDDK Diabetes

Pregnancies	Glucose	D_BP	Skin_Thickness	Insulin	BMI	Pedigree	Age	Outcome
6	148	72	35	0	33.6	0.627	50	1
1	85	66	29	0	26.6	0.351	31	0
8	183	64	0	0	23.3	0.672	32	1
1	89	66	23	94	28.1	0.167	21	0
0	137	40	35	168	43.1	2.288	33	1
5	116	74	0	0	25.6	0.201	30	0
3	78	50	32	88	31	0.248	26	1
10	115	0	0	0	35.3	0.134	29	0
2	197	70	45	543	30.5	0.158	53	1
8	125	96	0	0	0	0.232	54	1
4	110	92	0	0	37.6	0.191	30	0
10	168	74	0	0	38	0.537	34	1

Dataset type: Tabular Total dataset cells (columns x rows): 6912 (9 x 768) Data source: Local

Previewing up to the first 100 rows of NIDDK Diabetes

Pregnancies	Glucose	D_BP	Skin_Thickness	Insulin	BMI	Pedigree	Age	Outcome
6	148	72	35	0	33.6	0.627	50	1
1	85	66	29	0	26.6	0.351	31	0
8	183	64	0	0	23.3	0.672	32	1
1	89	66	23	94	28.1	0.167	21	0
0	137	40	35	168	43.1	2.288	33	1
5	116	74	0	0	25.6	0.201	30	0
3	78	50	32	88	31	0.248	26	1
10	115	0	0	0	35.3	0.134	29	0
2	197	70	45	543	30.5	0.158	53	1
8	125	96	0	0	0	0.232	54	1
4	110	92	0	0	37.6	0.191	30	0
10	168	74	0	0	38	0.537	34	1

Dataset type: Tabular Total dataset cells (columns x rows): 6912 (9 x 768) Data source: Local

✔ No issues have been found in your dataset

**Select a column to predict**

Choose the target column. The model that you build predicts values for the column that you select.

Target column

Value distribution



**Model type**

SageMaker Canvas automatically recommends the appropriate model type for your analysis.

💡 2 category prediction

Your model classifies Outcome into two categories.

Quick build

[Preview model](#)

**NIDDK Diabetes**

Full dataset: 768 rows

[Data visualizer](#)

Column name	Data type <sup>i</sup>	Feature type <sup>i</sup>	Missing <sup>i</sup>	Mismatched <sup>i</sup>	Unique <sup>i</sup>	Mode <sup>i</sup>	Correlation to target <sup>i</sup>	Feature importance <sup>i</sup> ↓
Outcome	Numeric	Binary	0.00% (0)	0.00% (0)	2	0	--	--
Glucose	Numeric	-	0.00% (0)	0.00% (0)	136	100	0.467	0.983576
BMI	Numeric	-	0.00% (0)	0.00% (0)	248	32	0.293	0.447098
Age	Numeric	-	0.00% (0)	0.00% (0)	52	22	0.238	0.305223
Pedigree	Numeric	-	0.00% (0)	0.00% (0)	517	0.25	0.174	0.230794
Pregnancies	Numeric	-	0.00% (0)	0.00% (0)	17	1	0.222	0.128893

Total columns: 9
  Total rows: 768
  Total cells: 6,912
  Show dropped columns

Target column

To see a recommended model type, specify a value for the target column.

Quick build

Preview model

NIDDK\_Diabetes

Full dataset: 768 rows

- Manage columns
- Manage rows
- Time series
- View all

Data visualizer

✓ Skin_Thick... 123	filter rows ✓ Pregnancies 123	✓ Pedigree 123	✓ Outcome 123	✓ Insulin 123	✓ Glucose 123	✓
0.00 94.05	0.00 16.15	0.08 1.76	2 Categories Binary	0.00 483.05	0.00 189.05	0.00
35	6	0.627	1	0	148	72
29	1	0.351	0	0	85	66
0	8	0.672	1	0	183	64
23	1	0.167	0	94	89	66
35	0	2.288	1	168	137	40
0	5	0.201	0	0	116	74
32	3	0.248	1	88	78	50
0	10	0.134	0	0	115	0
45	2	0.158	1	543	197	70
0	8	0.232	1	0	125	96
0	4	0.191	0	0	110	92
0	10	0.537	1	0	168	74

Add transform

Manage columns

Change data type  
Change the data type of a column.

Custom formula  
Use mathematical functions to explore and distribute your data.

Replace missing values  
Replace missing values with a custom value.

Replace outlier values  
Detect and fix outliers in numeric columns.

Manage rows

Drop duplicate rows  
Drop duplicate rows in your dataset.

Drop rows by formula  
Drop rows with values that match a specific condition.

Drop rows by missing values  
Drop rows that contain missing values.

Drop rows by outlier values  
Drop rows that contain outlier values.

Total columns: 9 Total rows: 768 Total cells: 6,912 Previewing first 100 rows  Show dropped columns

Target column

To see a recommended model type, specify a value for the target column.

Quick build

Preview model

NIDDK\_Diabetes

Full dataset: 768 rows

- Manage columns
- Manage rows
- Time series
- View all

Data visualizer

✓ Skin_Thick... 123	filter rows ✓ Pregnancies 123	✓ Pedigree 123	✓ Outcome 123	✓ Insulin 123	✓ Glucose 123	✓
35	6	0.627	1	0	148	72
29	1	0.351	0	0	85	66
0	8	0.672	1	0	183	64
23	1	0.167	0	94	89	66
35	0	2.288	1	168	137	40
0	5	0.201	0	0	116	74
32	3	0.248	1	88	78	50
0	10	0.134	0	0	115	0
45	2	0.158	1	543	197	70
0	8	0.232	1	0	125	96
0	4	0.191	0	0	110	92
0	10	0.537	1	0	168	74

Add transform

- Manage columns
- Change data type
- Custom formula
- Replace missing values
- Replace outlier values
- Manage rows
- Drop duplicate rows
- Drop rows by formula
- Drop rows by missing values
- Drop rows by outlier values

Total columns: 9 Total rows: 768 Total cells: 6,912 Previewing first 100 rows Show dropped columns



Select Build **Analyze** Predict Deploy

### Model status

Accuracy ⓘ

F1 ⓘ

Optimization metric

# 87.013%

0.821

The model predicts the correct Outcome 87.013% of the time. ⓘ

Predict

Deploy

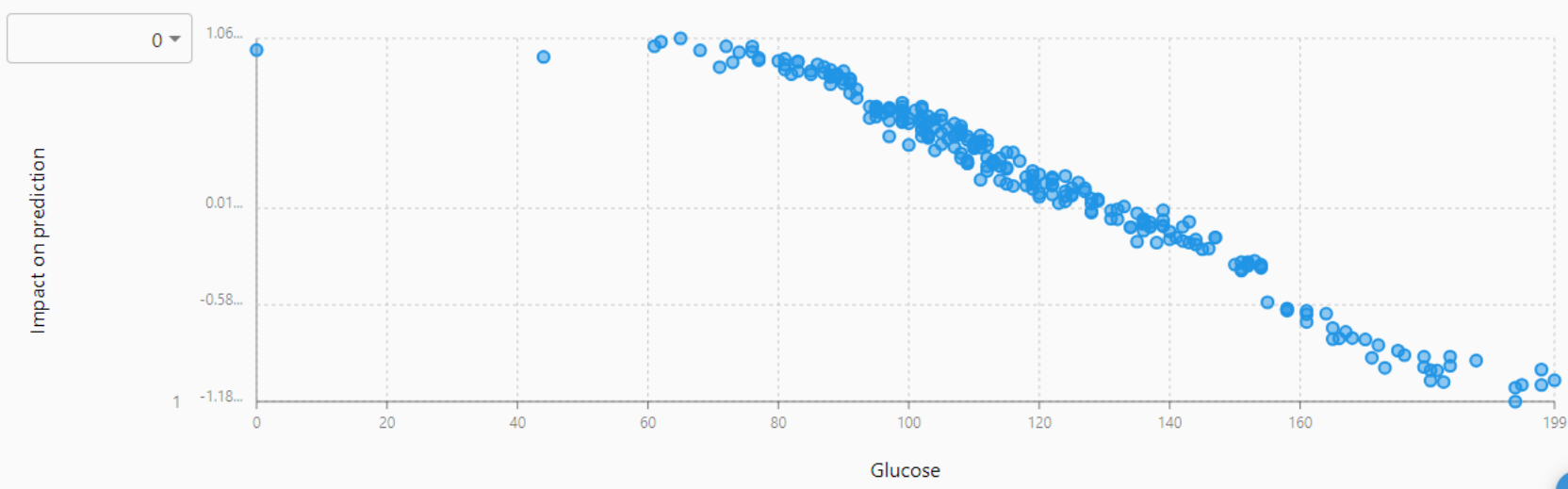
Overview Scoring

### Column impact ⓘ ↓

🔍 Search columns...

1	Glucose	43.248%
2	BMI	19.659%
3	Age	13.421%
4	Pedigree	10.148%
5	Pregnancies	5.667%
6	Insulin	2.892%

### Impact of Glucose on prediction of Outcome



Predict



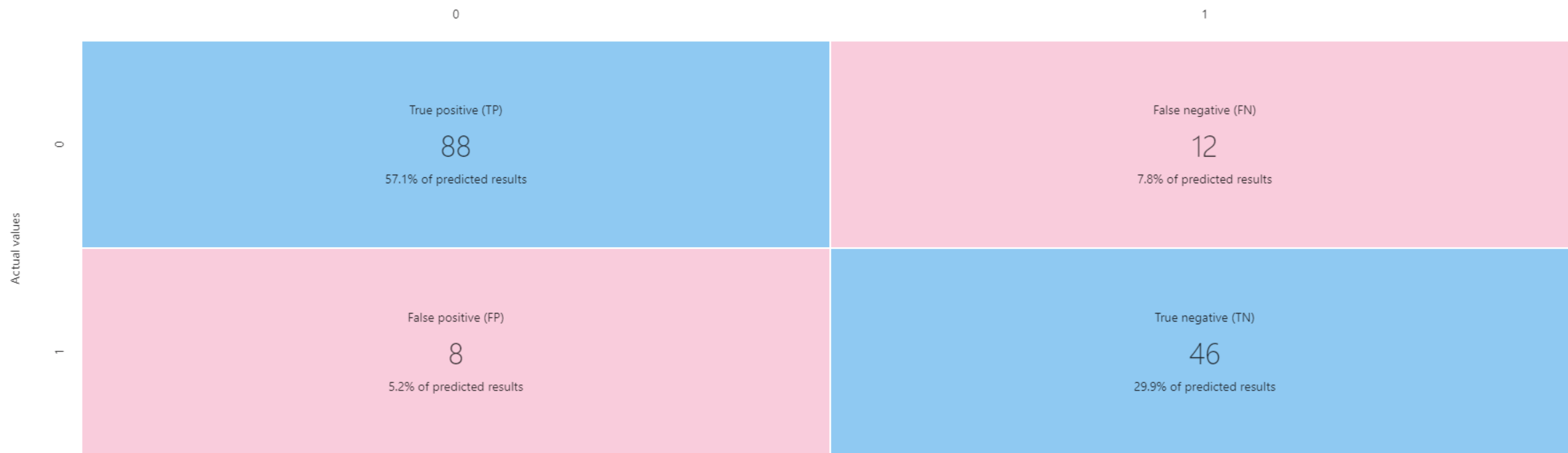
## Advanced metrics



Positive Class	F1 ⓘ Optimization metric	Accuracy ⓘ	Precision ⓘ	Recall ⓘ	AUC ⓘ
<input type="radio"/> 0 <input type="radio"/> 1	89.796%	87.013%	91.667%	88%	0.911

### Model performance

Predicted values



Close

Download

aws Services Search [Alt+S]

QuickSight Amazon Rekognition Amazon SageMaker S3 EFS

Amazon SageMaker X

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SageMaker dashboard

Search

JumpStart

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- Computer vision models
- Natural language processing models

Governance

Ground Truth

Notebook

Processing

CloudShell Feedback

N. Virginia fairclj

Amazon SageMaker

# SageMaker Studio

The first fully integrated development environment (IDE) for machine learning.

Get Started

Select user profile

default-20231017t000968

Open Studio

## How it works

**What is Studio?**

Amazon SageMaker Studio provides a single, web-based visual interface where you can perform all ML development steps, improving data science team productivity by up to 10x. SageMaker Studio gives you complete access, control, and visibility into each step required to build, train, and deploy models.

[Get Started with SageMaker](#)

## Features

### 1. Prepare

**Data Wrangler**

**Prepare Data in Minutes**

Using Amazon SageMaker Data Wrangler, you can quickly and easily prepare data and create model features. You can connect to data sources and build, train, and deploy models.

## Pricing (US)

With Amazon SageMaker Studio, you pay only for what you use. Authoring, training and hosting is billed by the second, with no minimum fees and no upfront commitments.

[Learn more](#)

## Documentation

- Tutorials
- [Developer Resources](#)
- [Developer Guide](#)

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- SageMaker JumpStart
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# Home

Customize layout

Quick actions

- Open Launcher  
Create notebooks and other resources
- Import & prepare data visually
- Open the Getting Started notebook
- Read documentation
- View guided tutorials

Prebuilt and automated solutions

Deploy built-in algorithms, pre-built solutions, example notebooks, and build models from visual interface.

- JumpStart  
Pretrained models, notebooks, and prebuilt solutions
- AutoML  
Automatically build, train, and tune the best ML models

Workflows and tasks

Kick off a new step in the machine learning workflow.

Prepare data	Build, train, tune model	Deploy model
<ul style="list-style-type: none"> <li>Connect to data sources</li> <li>Transform, analyze, and export data</li> <li>Store, manage, and retrieve features</li> <li>Manage EMR clusters</li> </ul>	<ul style="list-style-type: none"> <li>View all experiments</li> <li>Create AutoML experiment</li> <li>Get pretrained models</li> <li>Catalog models with model registry</li> <li>Compile model</li> </ul>	<ul style="list-style-type: none"> <li>Get endpoint recommendation</li> <li>Manage endpoints and optimize performance</li> </ul>



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## Create an Autopilot experiment

When you create an Autopilot experiment, Amazon SageMaker analyzes your data and creates a notebook with candidate model definitions. This notebook provides visibility into how models are selected, trained, and tuned.







Experiment and data details > Target and features > **Training method and algorithms** > Deployment and advanced settings > Review and create

### Training method and algorithms

Select the training method for solving your machine learning problems.

- Auto  
Let Autopilot automatically decide the training method based on your dataset size.
- Ensembling**  
Autopilot uses an AutoML algorithm that trains a multi-layer stack ensemble model to predict on regression and classification datasets directly from your data.
- Hyperparameter optimization (HPO)  
Autopilot finds the best version of a model by tuning hyperparameters and running training jobs on your data set.

Select the algorithms to improve model prediction accuracies. 7/8 algorithms selected  Select all

- LightGBM**  
A framework that uses tree-based algorithms, gradient boosting, and histogram-based algorithms to optimize speed and memory usage. Trees are grown leaf-wise where leaves with max delta loss are chosen to grow to optimize accuracy. 
- CatBoost**  
A framework that uses tree-based algorithms with gradient boosting. Optimized for handling categorical variables. 
- XGBoost**  
A supervised learning algorithm that attempts to accurately predict a target variable by combining an ensemble of estimates from a set of simpler and weaker models. 
- Random Forest**  
A tree-based algorithm that uses several decision trees on random sub-samples of the data with replacement. The trees are split into optimal nodes at each level. The decisions of each tree are averaged together to prevent overfitting and improve predictions. 
- Extra Trees**  
A tree-based ensemble algorithm that uses several decision trees built on the entire 
- Linear Models**  
A framework that uses a linear equation to model the relationship between target-label 



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- Hyperparameter optimization (HPO)  
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Select the algorithms to improve model prediction accuracies. 2/3 algorithms selected  Select all


**Linear Models**  
A framework that uses a linear equation to model the relationship between two variables target variable and feature variable in observed data.



**XGBoost**  
A supervised learning algorithm that attempts to accurately predict a target variable by combining an ensemble of estimates from a set of simpler and weaker models.



**MLP**  
A multilayer perceptron (MLP) and feedforward artificial neural network. This algorithm can handle data that is not linearly separable.

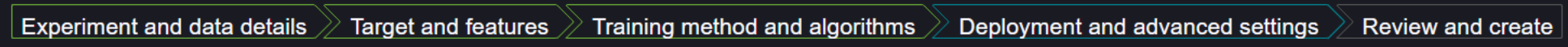




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# Create an Autopilot experiment

When you create an Autopilot experiment, Amazon SageMaker analyzes your data and creates a notebook with candidate model definitions. This notebook provides visibility into how models are selected, trained, and tuned.



## Deployment settings

Auto deploy creates an endpoint that deploys your best model and runs inference on the endpoint. Inference incurs account charges, but you can modify or delete the endpoint. [Learn more](#)

Auto deploy?  
 No

### Advanced settings (optional)

- Machine learning problem type
- Choose how to run your experiment
- Runtime
- Access
- Encryption
- Security
- Project
- Tags

Specify the type of machine learning problem for Autopilot to solve.

Select the machine learning problem type ⓘ

Auto

Cancel Previous: Training method Next: Review and create



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Experiment and data details > Target and features > Training method and algorithms > Deployment and advanced settings > Review and create

## Deployment settings

Auto deploy creates an endpoint that deploys your best model and runs inference on the endpoint. Inference incurs account charges, but you can modify or delete the endpoint. [Learn more](#)

Auto deploy?  
 No

### Advanced settings (optional)

- Machine learning problem type
 

Specify the type of machine learning problem for Autopilot to solve.

Select the machine learning problem type ⓘ

Binary classification
- Objective metric ⓘ
 

F1
- Choose how to run your experiment
- Runtime
- Access
- Encryption
- Security
- Project
- Tags

Cancel Previous: Training method Next: Review and create



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Diabetes

Problem type: BinaryClassification

Open candidate generation notebook | Open data exploration notebook

Trial Job profile

Best model	F1 Objective	LogLoss	Accuracy	Recall	Precision	AUC	BalancedAccuracy	Algorithm
Diabetes6xRkyQ8bmfilV79ZLO2m0Ew4-087-c0fc8759	0.682	0.525	0.744	0.788	0.603	0.836	0.754	MLP

View model details

Search... Share model Deploy model

Trial name	Objective: F1	Accuracy	BalancedAccuracy	AUC	Precision	Recall	Status
Diabetes6xRkyQ8bmf... Best model	0.682	0.744	0.754	0.836	0.603	0.788	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.682	0.74	0.753	0.835	0.597	0.798	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.681	0.737	0.753	0.832	0.594	0.804	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.68	0.739	0.751	0.834	0.598	0.792	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.678	0.733	0.75	0.834	0.59	0.804	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.678	0.744	0.751	0.838	0.604	0.774	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.677	0.752	0.751	0.834	0.62	0.75	Completed
Diabetes6xRkyQ8bmfilV79ZLO2...	0.677	0.743	0.75	0.831	0.604	0.774	Completed

100 results Results are cached Refresh Rows per page 8 Go to page 1 Page 1 of 13





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Autopilot

### DIABETES-AWS-AUTO-ML-JOB

COMPLETED

half a minute ago

Share model Deploy model Stop training job

Job Name: Diabetes-aws-auto-ml-job  
Model: Diabetes6xRkyQ8bmfIV79ZLO2m0Ew4-087-c0fc8759-aws-trial **Best model**  
Status: Completed  
Algorithm: MLP

Explainability Performance Artifacts Network

## Model explainability

Feature importance

Explaining your model's predictions

Amazon SageMaker Studio helps you understand your machine learning model by portraying the importance of its features in terms of SHAP values. We plot the aggregated SHAP value for each feature across all instances of the dataset.

Your analysis includes multiple predicted columns. Select a predicted column to see feature importance results:

0

Feature	Importance (Relative)
Glucose	0.45
BMI	0.35
Pregnancies	0.25
Age	0.22
Pedigree	0.22
D_BP	0.15
Insulin	0.10



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Manage model versions
  - Shared models  
Manage shared models & notebooks
  - Inference compiler  
Optimize trained models
  - Deployments
  - SageMaker JumpStart
  - Learning resources

Autopilot
less than a minute ago

Share model
Deploy model
Stop training job

**DIABETES-AWS-AUTO-ML-JOB**  
COMPLETED

Job Name: Diabetes-aws-auto-ml-job  
 Model: Diabetes6xRkyQ8bmfIV79ZLO2m0Ew4-087-c0fc8759-aws-trial Best model  
 Status: Completed  
 Algorithm: MLP  
 Problem Type: BinaryClassification

Explainability
Performance
Artifacts
Network

## Model explainability

**Feature importance**

**Metrics**

**Hyper parameters**

**Resource**

Metrics						
Name	Minimum	Maximum	Standard Deviation	Average	Count	Final value
ObjectiveMetric	0	0.7226890756302522	0	0	0	0.6823311448097229
validation:logloss	0	0.6915996651370804	0	0	0	0.5251949429512024
train:binary_f_beta	0	0.72	0	0	0	0.7053930163383484
train:binary_cross_entropy	0	147.6890869140625	0	0	0	95.4310073852539
validation:recall	0	0.8518518518518519	0	0	0	0.7882100343704224
train:throughput	0	12818.883710226044	0	0	0	12742.927734375
validation:accuracy	0	0.7857142857142857	0	0	0	0.7438430190086365
train:roc_auc	0	0.8654672897196262	0	0	0	0.8619132041931152
validation:binary_f_beta	0	0.7226890756302522	0	0	0	0.6823311448097229
validation:balanced_accuracy	0	0.7881481481481482	0	0	0	0.7541050314903259
validation:roc_auc	0	0.8337037037037037	0	0	0	0.8358103632926941
train:accuracy	0	0.7833876221498371	0	0	0	0.7590972781181335
validation:precision	0	1	0	0	0	0.6030615568161011



Autopilot less than a minute ago

**DIABETES-AWS-AUTO-ML-JOB**  
COMPLETED

Job Name: Diabetes-aws-auto-ml-job  
 Model: Diabetes6xRkyQ8bmfilV79ZLO2m0Ew4-087-c0fc8759-aws-trial **Best model**  
 Status: Completed  
 Algorithm: MLP

Share model | Deploy model | Stop training job

Job Details: Job Name, Model, Status, Algorithm

Performance | Explainability | Artifacts | Network

## Model performance

[Download Performance Reports](#)

**Metrics table**

- Confusion Matrix**
- Precision Recall Curve
- ROC curve

Note:  
The values of the performance metrics in this table may differ from the values reported by Autopilot. The differences tend to appear when training on smaller datasets. The values for the metrics in the table use all the training data once to estimate the performance of a model. Autopilot scores are calculated using k-fold cross-validation resampling method that train a machine learning algorithm on different subsets of the dataset. A score is then calculated for overall performance by averaging the resulting performance metrics for each trial.

Confusion Matrix

Predicted \ Actual	0	1
0	362 (47.14%)	138 (17.97%)
1	54 (7.03%)	214 (27.86%)



- Home
- Data
- AutoML
- Experiments
- Notebook jobs
- Pipelines
- Models
- Deployments
- SageMaker JumpStart
- Learning resources

Autopilot

### DIABETES-AWS-AUTO-ML-JOB

COMPLETED

less than a minute ago

Share model Deploy model Stop training job

Job Name: Diabetes-aws-auto-ml-job  
Model: Diabetes6xRkyQ8bmfIV79ZLO2m0Ew4-087-c0fc8759-aws-trial **Best model**  
Status: Completed  
Algorithm: MLP

Explainability Performance Artifacts Network

## Model performance

Download Performance Reports

Metrics table  
Confusion Matrix  
Precision Recall Curve  
ROC curve

Precision Recall Curve

Precision-Recall (AUPRC = 0.72)

Receiver Operating Characteristic (ROC)



- Home
- Data
- AutoML
- Experiments
- Notebook jobs
- Pipelines
- Models
- Deployments
- SageMaker JumpStart
- Learning resources

Autopilot

DIABETES-AWS-AUTO-ML-JOB

COMPLETED

less than a minute ago

Share model Deploy model Stop training job

Job Name: Diabetes-aws-auto-ml-job  
Model: Diabetes6xRkyQ8bmfiV79ZLO2m0Ew4-087-c0fc8759-aws-trial **Best model**  
Status: Completed  
Algorithm: MLP

Explainability Performance Artifacts Network

### Model performance

Download Performance Reports

Metrics table  
Confusion Matrix  
Precision Recall Curve  
ROC curve

Receiver Operating Characteristic (ROC)

ROC Curve (AUC = 0.84)

False Positive Rate (x-axis)	True Positive Rate (y-axis)
0.0	0.0
0.1	0.55
0.2	0.70
0.3	0.80
0.4	0.85
0.5	0.90
0.6	0.95
0.7	0.98
0.8	0.99
0.9	1.00
1.0	1.00



SEARCH

**WARNING**

The JupyterLab development team is excited to have a robust third-party extension community. However, we do not review third-party extensions, and some extensions may introduce security risks or contain malicious code that runs on your machine. Moreover in order to work, this panel needs to fetch data from web services. Please read the privacy policy.

Enable

INSTALLED

DISCOVER

Experiment: Diabetes

Model: Diabetes6xRkyQ8bmfilV79ZLO2m0Ew4-087-c0fc8759

## Deploy model

Select a deployment method for your model to make predictions.

- Make real-time predictions  
Deploy your model to make real-time predictions with a Sagemaker endpoint. [Learn more](#)
- Make batch predictions  
Generate batch predictions on a set of observations where latency is not a requirement. [Learn more](#)

New Batch Prediction Batch Transform Jobs

**Batch transform job configuration**

Job name ⓘ  
Diabetes6xRkyQ8bmfilV79ZLO2m0Ew4-087-c

Model  
Diabetes6xRkyQ8bmfilV79ZLO2m0Ew4-087-c

Instance type ⓘ Instance count ⓘ  
ml.m5.2xlarge 1

S3 Encryption key - Optional ⓘ  
No custom encryption

Inference Response Content ⓘ



# Fall 2023: RUCOM Joined the AWS Academy

- AWS Academy provides free, ready-to-teach cloud computing curriculum, built by the experts at AWS, that fit into existing course structures and include lectures, hands-on labs, knowledge checks, and projects.
- Students/learners can enroll in courses that teach in-demand cloud skills, allowing them to solve business challenges based on actual industry scenarios (including healthcare).
- Educators receive complimentary professional development and mentorship to enhance their own research capacity and industry knowledge.



# AWS Certifications

<https://aws.amazon.com/certification/>



## FOUNDATIONAL

Knowledge-based certification for foundational understanding of AWS Cloud.

**No prior experience needed.**



## PROFESSIONAL

Role-based certifications that validate advanced skills and knowledge required to design secure, optimized, and modernized applications and to automate processes on AWS.

**2 years of prior AWS Cloud experience recommended.**



## ASSOCIATE

Role-based certifications that showcase your knowledge and skills on AWS and build your credibility as an AWS Cloud professional. **Prior cloud and/or strong on-premises IT experience recommended.**



## SPECIALTY

Dive deeper and position yourself as a trusted advisor to your stakeholders and/or customers in these strategic areas. **Refer to the exam guides on the exam pages for recommended experience.**



### AWS Certified AI Practitioner (AIF-C01) Exam

120 minutes | 85 questions | \$75 USD

Fundamentals of AI and ML

Fundamentals of Generative AI

Applications of Foundation Models

Guidelines for Responsible AI

Security, Compliance, and Governance for AI Solutions

### AWS Certified Machine Learning - Specialty Exam (MLS-C01)

180 minutes | 65 questions | \$300 USD

Data Engineering

Exploratory Data Analysis

Modeling

Machine Learning Implementation and Operations



# AWS Educate

Build your cloud skills at your own pace, on your own time, and completely for free

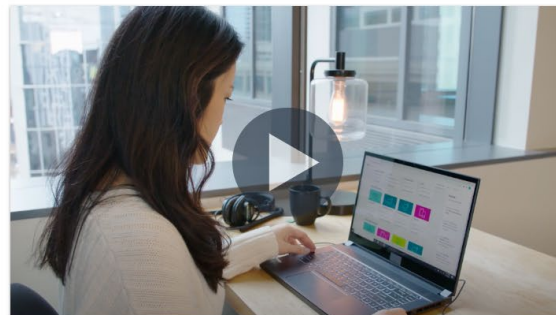
Register now





[Sign in to AWS Educate](#)

## Start your cloud journey with AWS Educate today

AWS Educate is open to any individual, regardless of where they are in their education, technical experience, or career journey.

If you're overwhelmed by too many choices when it comes to learning about the cloud, AWS Educate is here to help. Cloud beginners like you are invited to check out our free, self-paced online training resources and labs designed to help you learn, practice, and evaluate your cloud skills without having to create an Amazon account.



 <p><b>Simple, barrier-free access</b></p> <p>Learners as young as 13 can register for AWS Educate with just an email address, gaining access to free hands-on labs in the AWS Console to learn, practice, and evaluate cloud skills in real-time. No credit card needed.</p>	 <p><b>Content designed for beginners</b></p> <p>AWS Educate offers hundreds of hours of learning resources focused on the new-to-cloud learner. Prefer to learn by video or by tinkering in the AWS Cloud? We've got something for everyone.</p>	 <p><b>Connection to employment</b></p> <p>Learners can access the AWS Educate Job Board to explore, search for, and apply to thousands of in-demand jobs and internships with organizations of all types all over the world.</p>	 <p><b>Build your network</b></p> <p>Complete courses with hands-on labs to earn digital badges and score an invitation to the AWS Emerging Talent Community, your place to connect with other early career talent.</p>
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<https://aws.amazon.com/education/awseducate/>



# Nevada Department of Health and Human Services

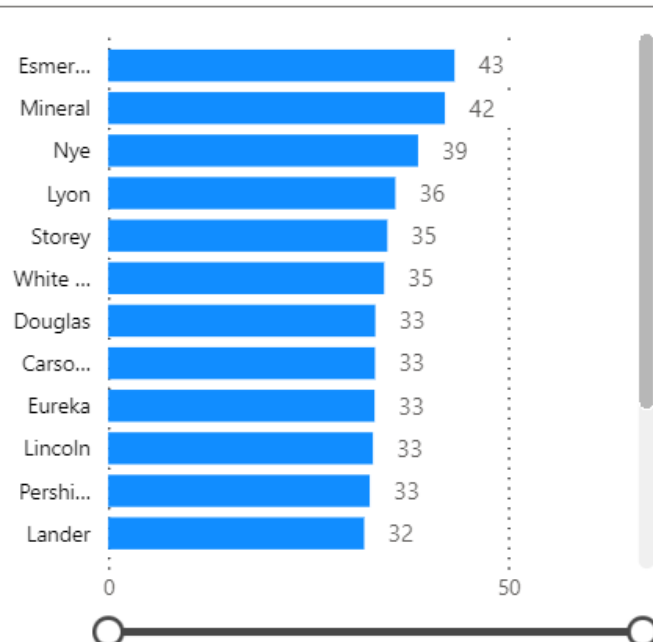
Helping People  
It's who we are and what we do.

Microsoft Power BI Interactive Report | State of Nevada  
Creator: Dr. Jamie Fairclough

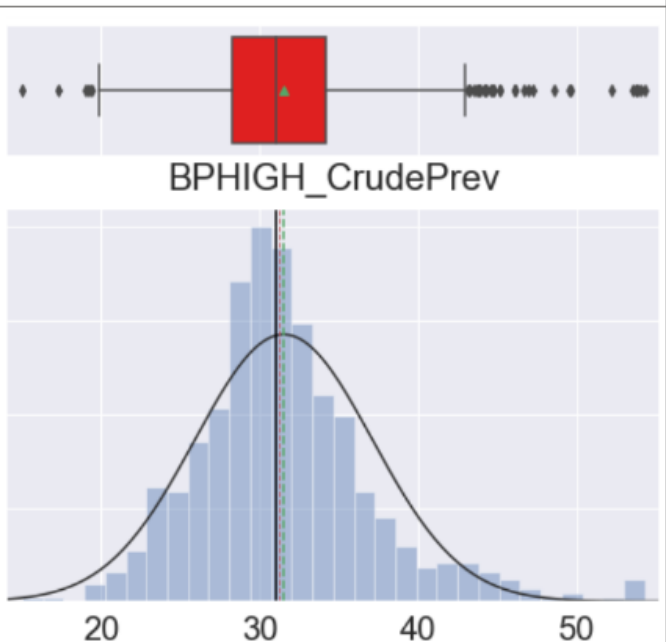
### Average BPHIGH CrudePrev

County	CrudePrev	95% CI
Clark	54.30	(49.3, 58.9)
Clark	54.00	(49.5, 58.7)
Clark	53.90	(49.0, 58.5)
Clark	53.70	(49.0, 58.3)
Clark	52.20	(47.4, 57.1)
Clark	49.70	(45.9, 53.3)
Clark	49.60	(45.0, 54.2)
Clark	48.60	(44.3, 53.1)
Clark	47.30	(43.2, 51.3)
Clark	47.00	(43.3, 50.7)
Clark	46.70	(43.1, 50.5)
Mineral	46.10	(40.7, 51.1)
Clark	46.10	(42.2, 50.1)
Clark	46.10	(42.4, 49.9)
Clark	45.20	(41.1, 49.6)
Clark	45.20	(41.7, 48.8)
Clark	44.80	(41.3, 48.2)
Clark	44.65	(40.9, 48.3)

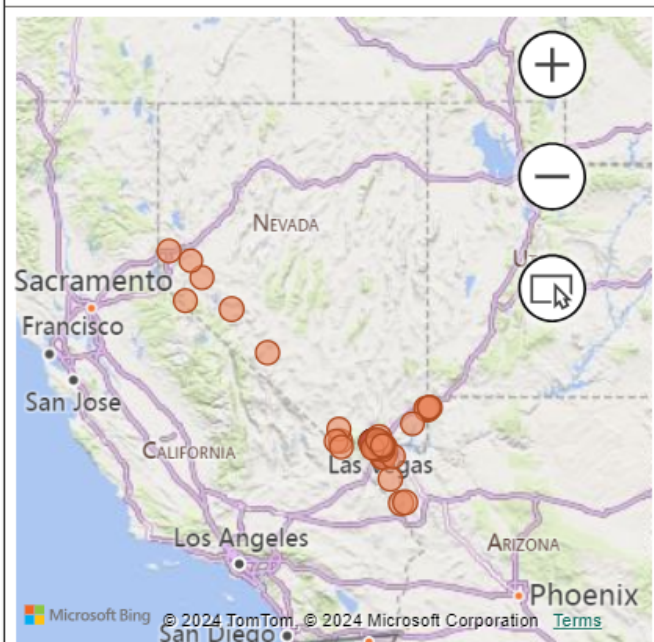
### Average BPHIGH\_CrudePrev (by County)



### Boxplot & Histogram BPHIGH\_CrudePrev



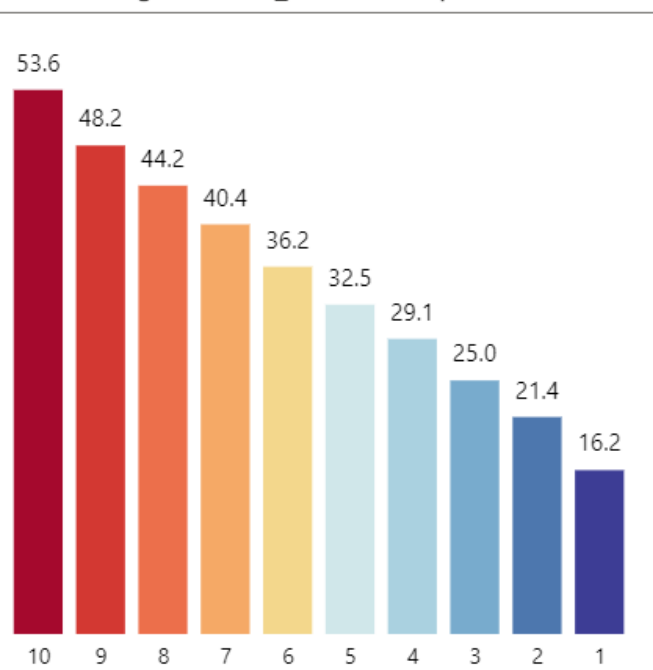
### Priority Census Tracts (CrudePrev >= 40)



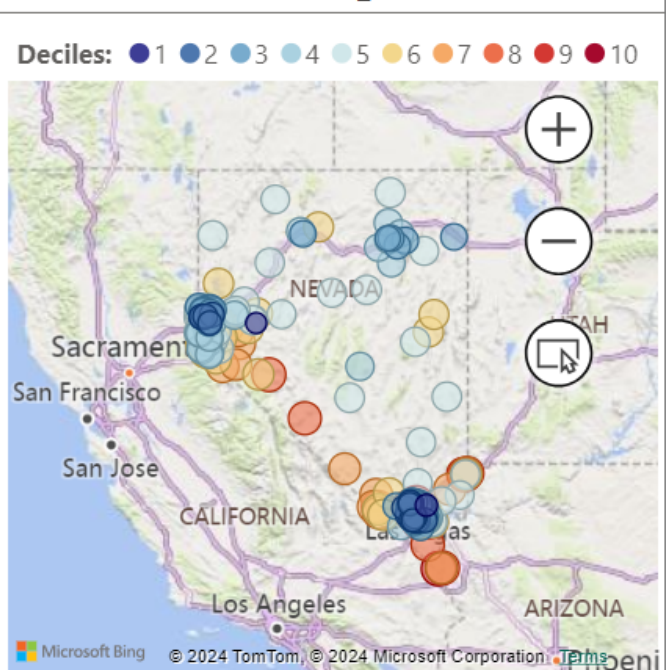
### BPHIGH Deciles by County

Decile	County	Outlier	Population
10	Clark	True	2997
10	Clark	True	2797
10	Clark	True	2446
10	Clark	True	1971
10	Clark	True	1951
9	Clark	True	5946
9	Clark	True	3880
9	Clark	True	3852
9	Clark	True	3002
9	Clark	True	2865
9	Clark	True	2206
8	Clark	True	4259
8	Clark	True	3950
8	Clark	True	3585
8	Clark	True	3527
8	Clark	True	3314
8	Clark	True	3226
8	Clark	True	3103

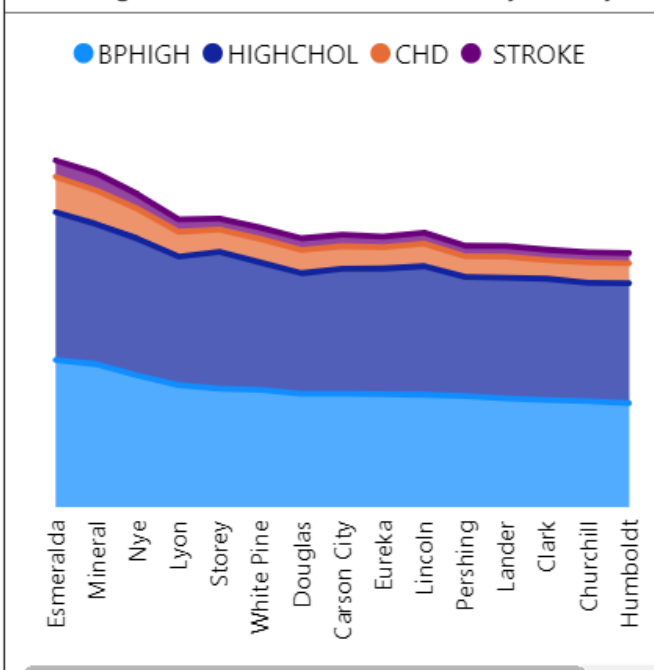
### Average BPHIGH\_CrudePrev (per Decile)



### Geolocation for BPHIGH\_CrudePrev Deciles



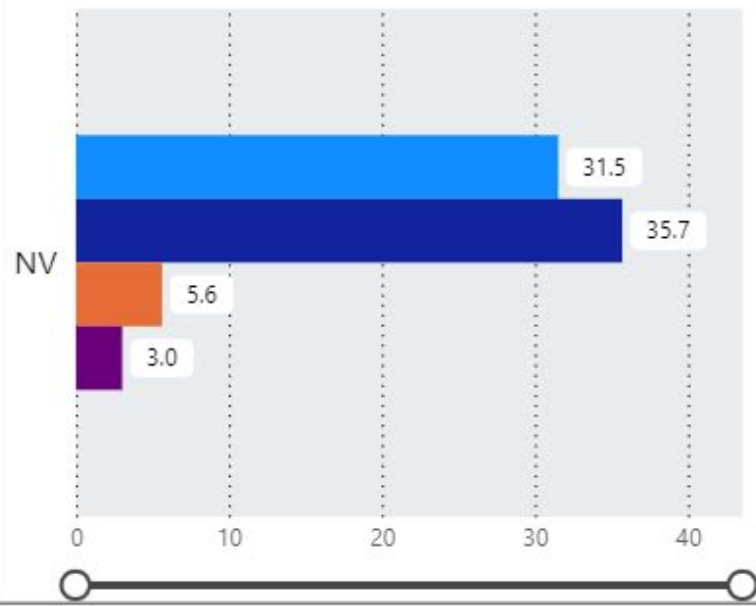
### Average CrudePrev Comorbidities (by County)





### Average CrudePrev for all NV Counties

● BPHIGH ● HIGHCHOL ● CHD ● STROKE



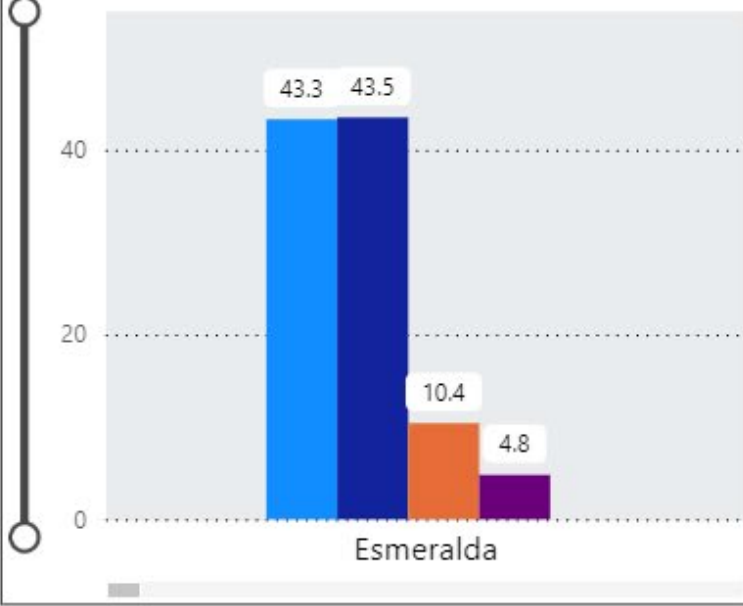
### Average CrudePrev by County [View 1: Census Tract Count]

● BPHIGH ● HIGHCHOL ● CHD ● STROKE



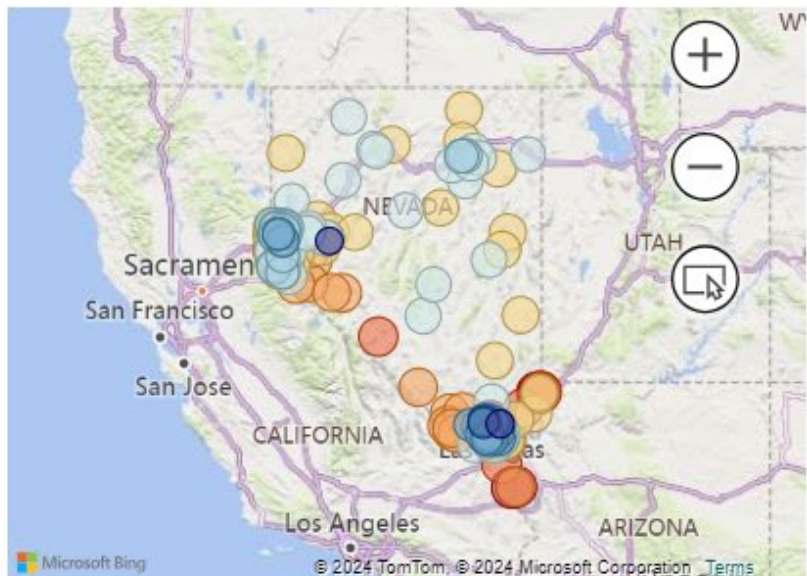
### Average CrudePrev by County [View 2: Population Sum]

● BPHIGH ● HIGHCHOL ● CHD ● STROKE



### HIGHCHOL Deciles by Geolocation

Deciles: ● 1 ● 2 ● 3 ● 4 ● 5 ● 6 ● 7 ● 8 ● 9 ● 10



### CHD Deciles by Geolocation

Deciles: ● 1 ● 2 ● 3 ● 4 ● 5 ● 6 ● 7 ● 8 ● 9 ● 10



### STROKE Deciles by Geolocation

Deciles: ● 1 ● 2 ● 3 ● 4 ● 5 ● 6 ● 7 ● 8 ● 9 ● 10



### Total Population\_SVI

Population Count

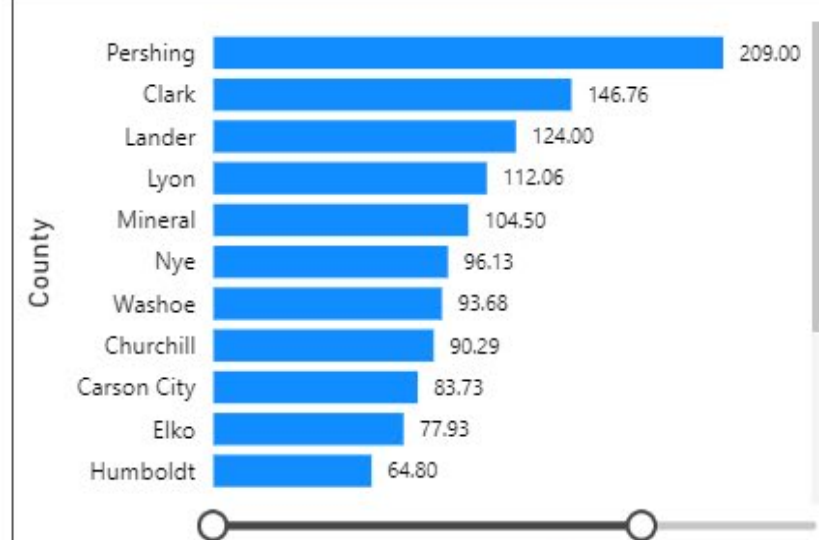
### Zero Population\_SVI

County	Count	Zip	Population	Area_Sq Miles
Washoe	1	89506	0	5.88
Washoe	1	89506	0	27.16
Nye	1	89023	0	4,180.10
Carson City	1		0	0.00
Douglas	1		0	0.00
Washoe	2		0	0.00
<b>Total</b>	<b>7</b>			

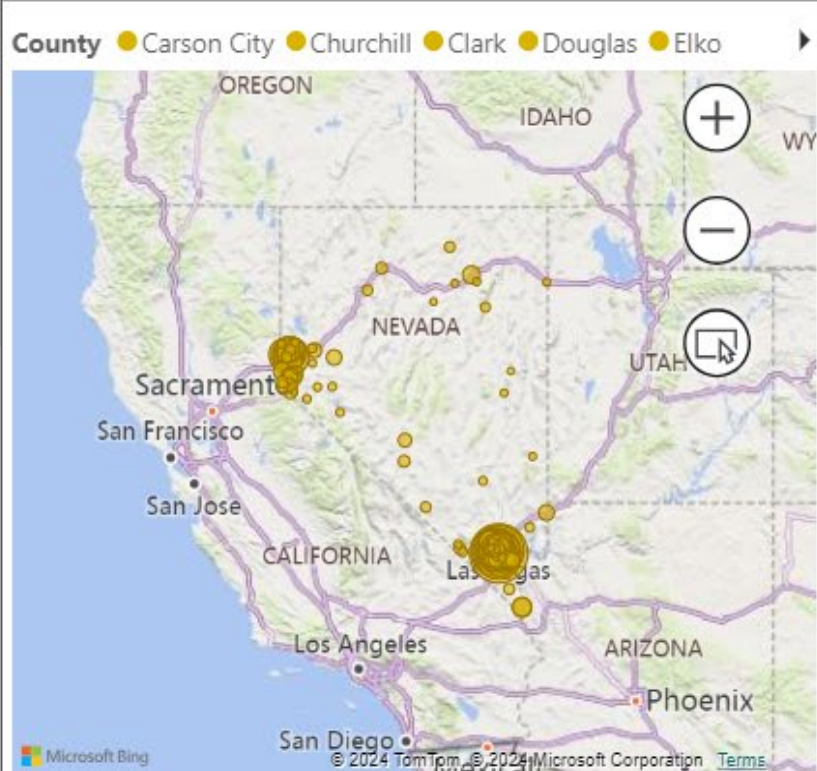
### Poverty and Housing Cost-Burdened\_SVI

Zip Code	County	Average of 150% Below FPL	Average Housing Cost-Burdened	Avg BPHIGH_Crude Prev
89801	Elko	671.14	248.29	28.16
89815	Elko	700.00	220.00	28.16
89822	Elko	248.00	103.00	28.16
89828	Elko	355.00	128.00	28.16
89833	Elko	583.00	85.00	28.16
89834	Elko	714.00	156.00	28.16
89883	Elko	1121.00	382.00	28.16
	Washoe	0.00	0.00	29.88
<b>Average</b>		<b>841.61</b>	<b>462.98</b>	<b>31.52</b>

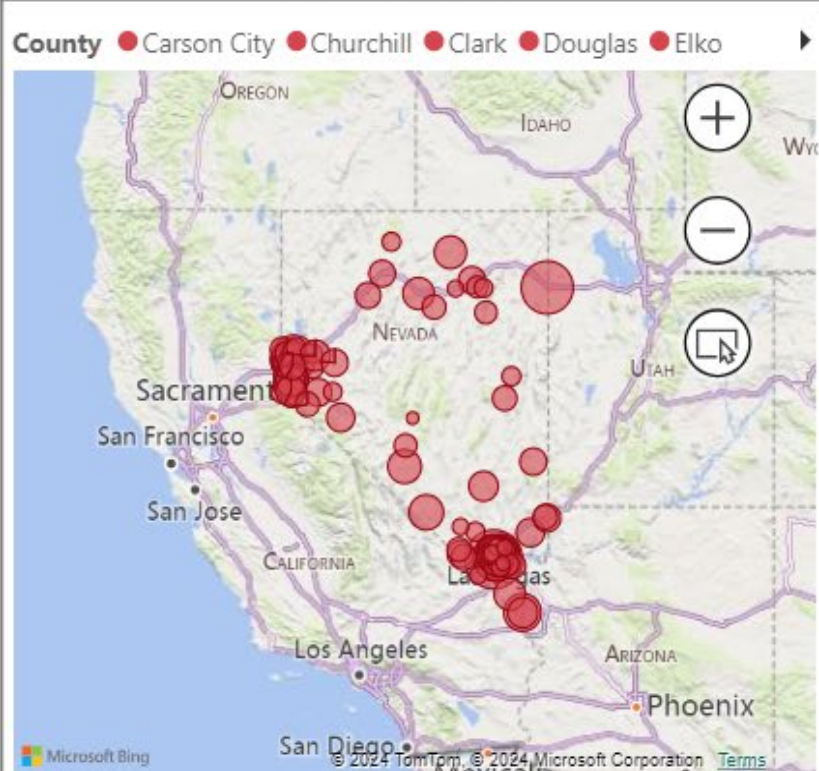
### Average Unemployment by County\_SVI



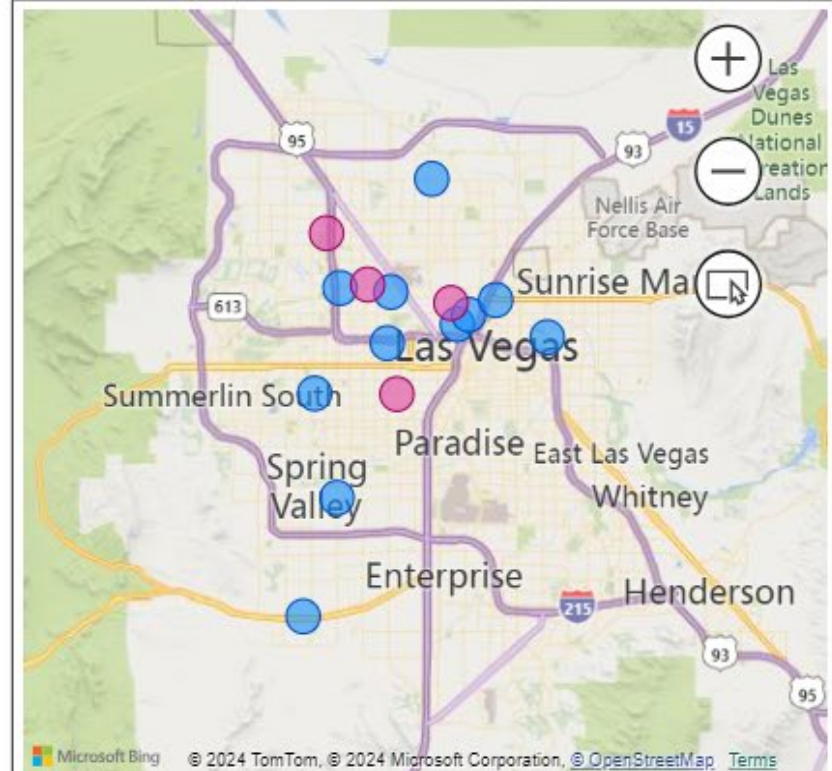
### Average of Multi-Unit Structures\_SVI



### Average of No Vehicle\_SVI



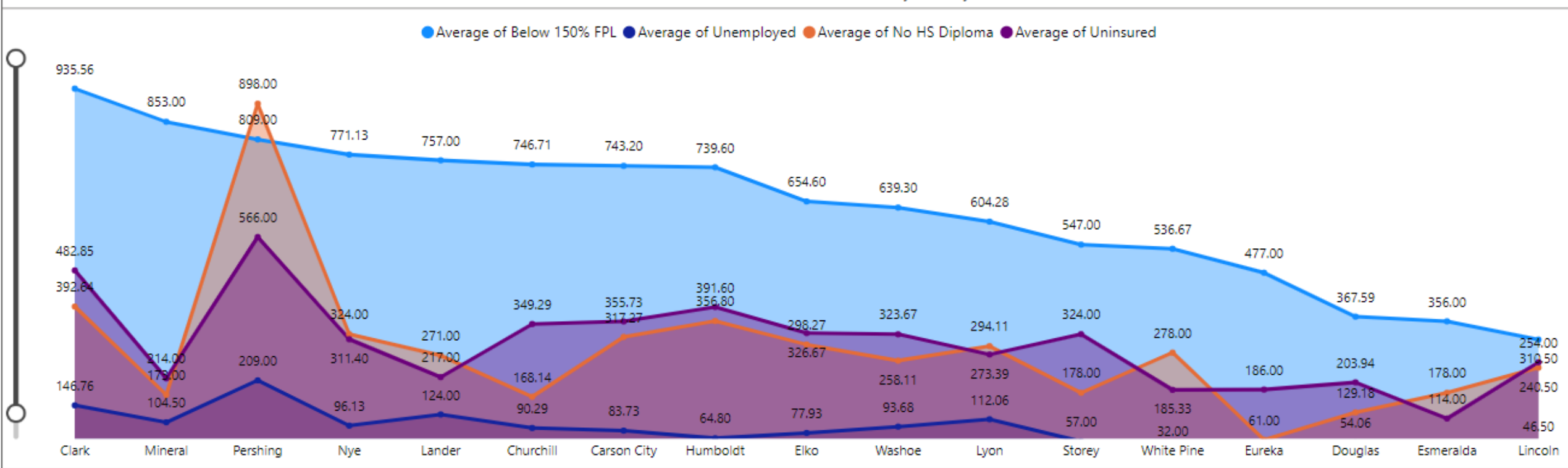
### Partner Locations\_SVI



### Socioeconomic Status and CrudePrev Rates

County	Zip Code	Average of Below 150% FPL	Average of Unemployed	Average of No HS Diploma	Average of Uninsured	Average BPHIGH_CrudePrev	Average of HIGHCHOL_CrudePrev	Average of CHD_CrudePrev	Average of STROKE_CrudePrev	Average of Minority
Esmeralda	89013	356.00	12.00	178.00	114.00	43.30	43.50	10.40	4.80	164.00
Mineral	89415	878.00	99.00	205.00	240.00	42.10	41.15	9.90	5.10	217.00
Mineral	89427	828.00	110.00	141.00	188.00	42.10	41.15	9.90	5.10	212.00
Nye	89003	1017.00	43.00	395.00	461.00	38.74	40.26	8.79	4.31	410.00
Nye	89022	370.00	6.00	183.00	61.00	38.74	40.26	8.79	4.31	268.00
Nye	89023	0.00	0.00	0.00	0.00	38.74	40.26	8.79	4.31	34.00
Nye	89048	755.20	115.20	430.20	327.80	38.74	40.26	8.79	4.31	323.00
Nye	89049	490.00	100.00	109.00	116.00	38.74	40.26	8.79	4.31	278.00
Nye	89060	969.25	102.75	292.75	405.75	38.74	40.26	8.79	4.31	283.00
Nye	89061	1018.50	153.00	425.50	385.50	38.74	40.26	8.79	4.31	347.50
<b>Average</b>		<b>841.61</b>	<b>128.65</b>	<b>351.73</b>	<b>428.92</b>	<b>31.52</b>	<b>35.70</b>	<b>5.63</b>	<b>3.02</b>	<b>528.80</b>

### Estimates of Socioeconomic Status (by County)



# AI Plans for State Health Department Project



- Use supervised machine learning (ML) to predict cardiovascular health outcomes and identify the most important factors contributing to adverse cardiac events.
- Utilize unsupervised ML for cluster analysis to segment the population based on cardiovascular risk factors and social determinants/drivers of health.
- Leverage Neo4j's graph database to model and analyze complex relationships, uncovering hidden patterns and insights within interconnected population health data.
- Engage in geo-AI research to improve disease surveillance capabilities, particularly in rural/frontier settings.

# May 2024 Meeting: Healthcare AI/Tech Workforce Development (NV)

ORGANIZATION	ATTENDEES
<p><b>Roseman University of Health Sciences College of Medicine</b></p>	<ul style="list-style-type: none"> <li>• Associate Dean &amp; Professor   Data Science &amp; Engineering Unit Director</li> <li>• Biomedical Data Scientist</li> <li>• Data Scientist / Engineer</li> </ul>
<p><b>Amazon Web Services (AWS)</b></p>	<ul style="list-style-type: none"> <li>• Sr. Account Manager, Higher Education</li> <li>• Solutions Architect</li> <li>• Academic Medicine &amp; State/Local Government Providers</li> <li>• Public Health Lead   US State &amp; Local Government</li> <li>• Worldwide Public Sector   State &amp; Local Government</li> <li>• Interoperability &amp; Public Health   State &amp; Local Government</li> </ul>
<p><b>Nevada Department of Health and Human Services</b></p>	<ul style="list-style-type: none"> <li>• Bureau Chief, Child, Family and Community Wellness</li> <li>• Nutrition Unit Deputy Chief</li> <li>• Population and Health Services Manager</li> <li>• Community Wellness Manager   Chronic Disease Prevention and Health Promotion</li> <li>• Cardiovascular Health Program Coordinator</li> <li>• Chronic Disease Data Coordinator</li> <li>• Biostatistician</li> </ul>
<p><b>Southern Nevada Health District</b></p>	<ul style="list-style-type: none"> <li>• Deputy District Health Officer-Operations</li> <li>• Director of Disease Surveillance and Control</li> <li>• Epidemiology Supervisor</li> <li>• Public Health Informatics Supervisor</li> <li>• Senior Epidemiologist</li> </ul>
<p><b>City of Las Vegas</b></p>	<ul style="list-style-type: none"> <li>• Workforce Development Officer</li> <li>• Workforce Development Specialist</li> <li>• Management Analyst</li> </ul>
<p><b>American Board of Artificial Intelligence in Healthcare</b></p>	<ul style="list-style-type: none"> <li>• Co-Founder &amp; Chief Scientific Officer   VA Radiologist</li> <li>• Board Member   Vice Provost</li> </ul>
<p><b>Johns Hopkins Engineering</b></p>	<ul style="list-style-type: none"> <li>• Associate Director   Corporate Engagement for Professional Education</li> </ul>



# Considerations for Resource-Constrained Institutions

- Identify community stakeholders interested in AI to build a network for future collaborations or partnerships.
- Leverage scalable compute resources provided by cloud providers (e.g., AWS, Google Cloud, Microsoft) to build and deploy AI/ML models.
- Outsource advanced model development, refinement, and deployment activities to industry partners or data science teams at other academic institutions.
- Partner with industry or other institutions to train faculty, staff, and students/learners on building, managing, and deploying AI projects in cloud environments.

# Considerations for Resource-Intensive Institutions

- Offer guidance and best practices on runtime configurations for cloud AI projects underway at smaller/resource-limited institutions.
- For compute-intensive projects, use cloud providers to tap into more powerful resources (e.g., TPUs, Quantum Machine Learning [QML]).
  - Explore how QML is being used in medical research and how it may benefit medical education (e.g., quantum algorithms training on smaller datasets).
- Partner with industry partners (e.g., systems engineers) to advise on how to design intelligent systems for medical/health professions education.
- Work with internal/external data science and engineering teams to strengthen data security/compliance practices and automate seamless integration of structured and unstructured data across disparate systems.



Tomorrow's Doctors, Tomorrow's Cures®

# Building AI Partnerships Across Medicine, Industry, and Government

Jamie Fairclough, PhD, MPH, MS  
Roseman University of Health Sciences | College of Medicine

Email: [jfairclough@roseman.edu](mailto:jfairclough@roseman.edu)

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Learn

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Serve

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Lead



Association of  
American Medical Colleges

# MedEdMentor

AAMC AI Webinar

Geoffrey Stetson - Gregory Ow



# Disclosure

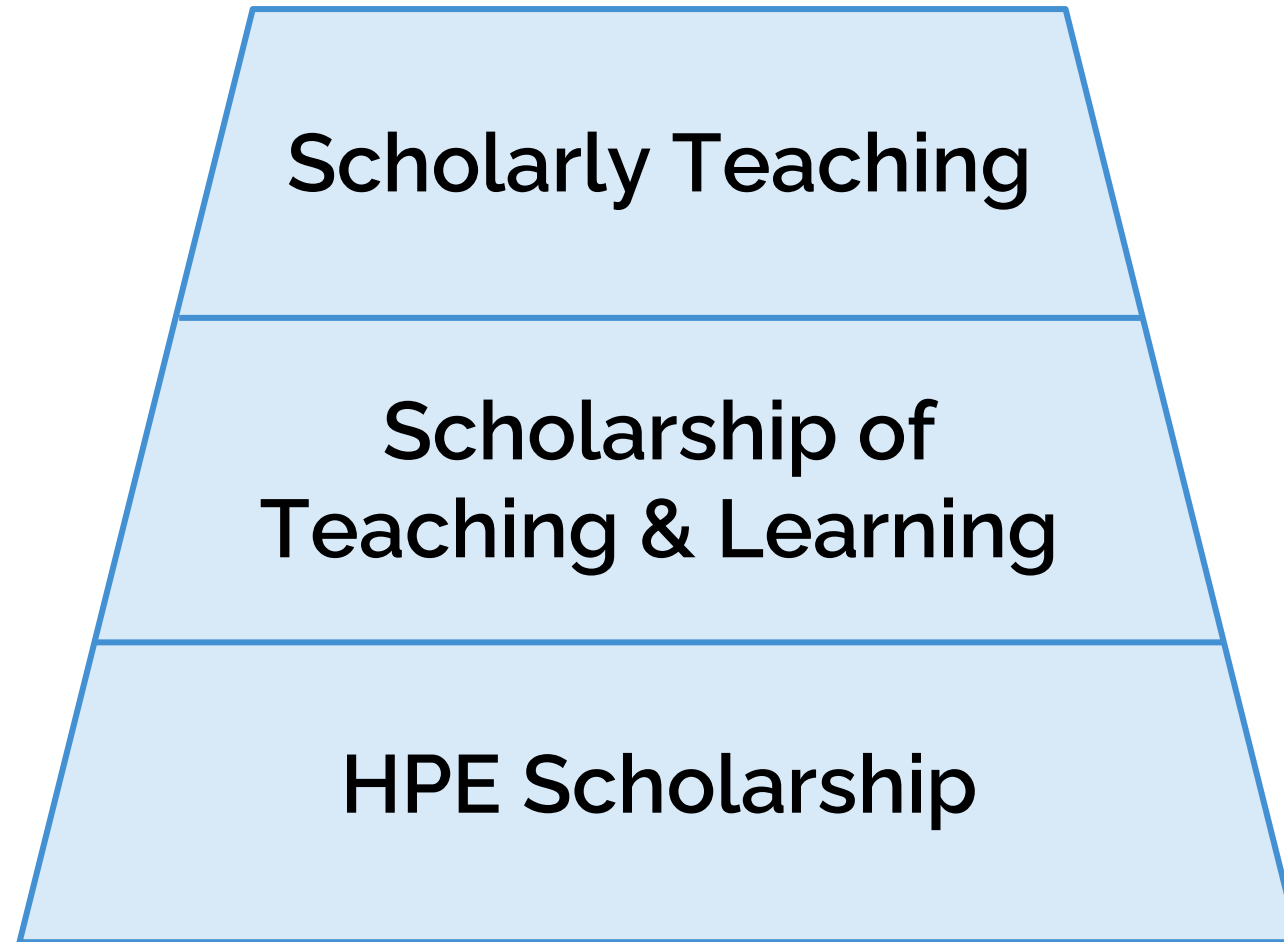
- MedEdMentor is a limited liability company
- Geoff and Greg are co-owners
- Our lifetime revenue is \$0
- Josiah Macy Jr. Foundation Grant



# Background



# We need scholarship at all levels



# Personal scholarship struggles

*“Early career researchers and those new to theory express challenges employing theory, as well as difficulties with theory-related terminology”*





# Scholarship is a common struggle

## Scholarly Teaching

*“Many academic faculty members are educators, yet few are familiar with key education theories that inform their practice”*



# Scholarship is a common struggle

## Scholarly Teaching

*“Many academic faculty members are educators, yet few are familiar with key education theories that inform their practice”*

## Scholarship of Teaching & Learning

*“Changes [in the field]...have been made in the absence of supportive theory, or at least by a poor understanding of educational theory”*



# Scholarship is a common struggle

## Scholarly Teaching

*“Many academic faculty members are educators, yet few are familiar with key education theories that inform their practice”*

## Scholarship of Teaching & Learning

*“Changes [in the field]...have been made in the absence of supportive theory, or at least by a poor understanding of educational theory”*

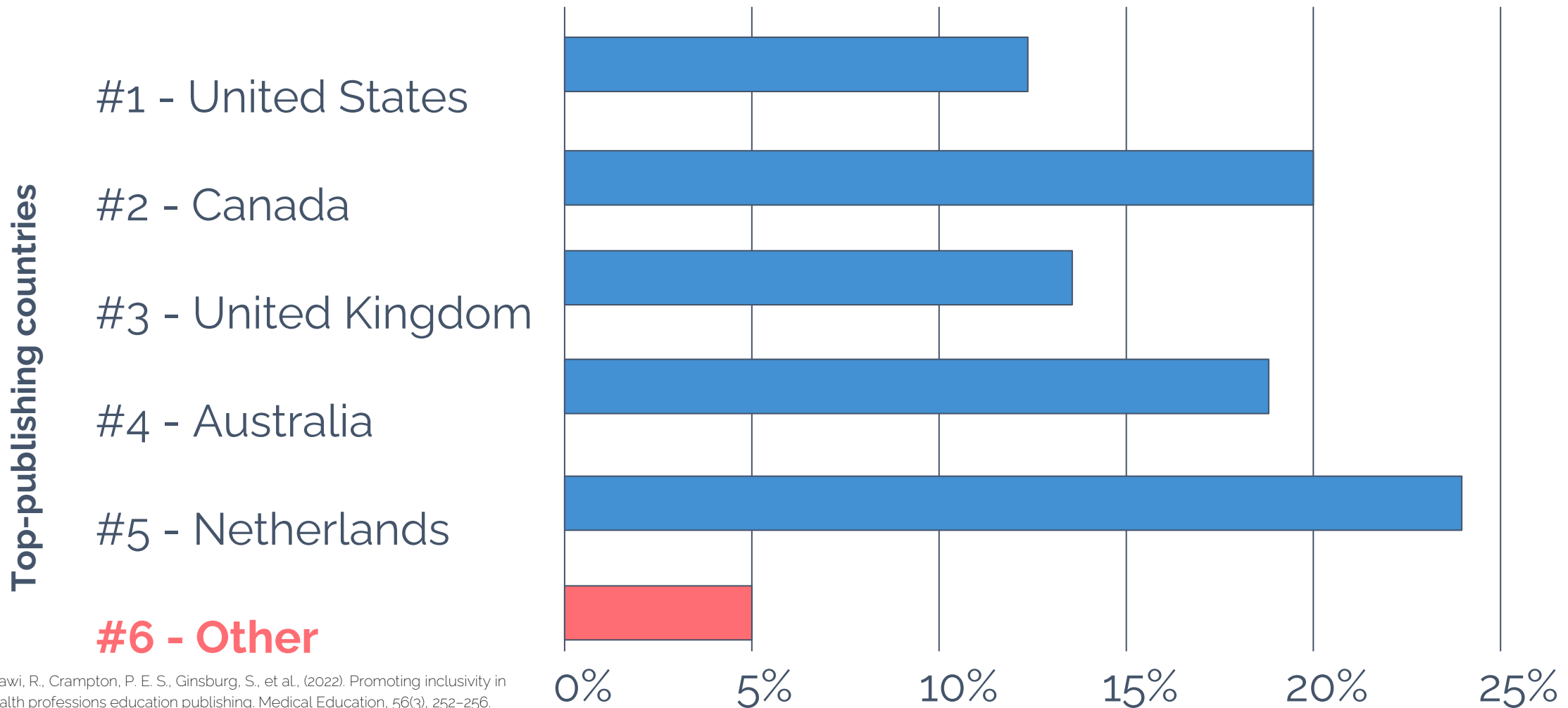
## HPE Scholarship

*“HPE researchers...particularly those who do not have a background in education or social sciences, may lack a strong grasp of theory”*



# HPE scholarship lacks diversity

Manuscript acceptance rate - *Medical Education*



Unequal distribution of resources, expertise, and mentorship is a primary driver of the continued struggles of aspiring HPE scholars and the lack of diverse voices in HPE literature



# MedEdMentor.org



Account ▾

## Find clarity in your research journey

The AI mentor for health professions education research.

Launch MedEdMentor

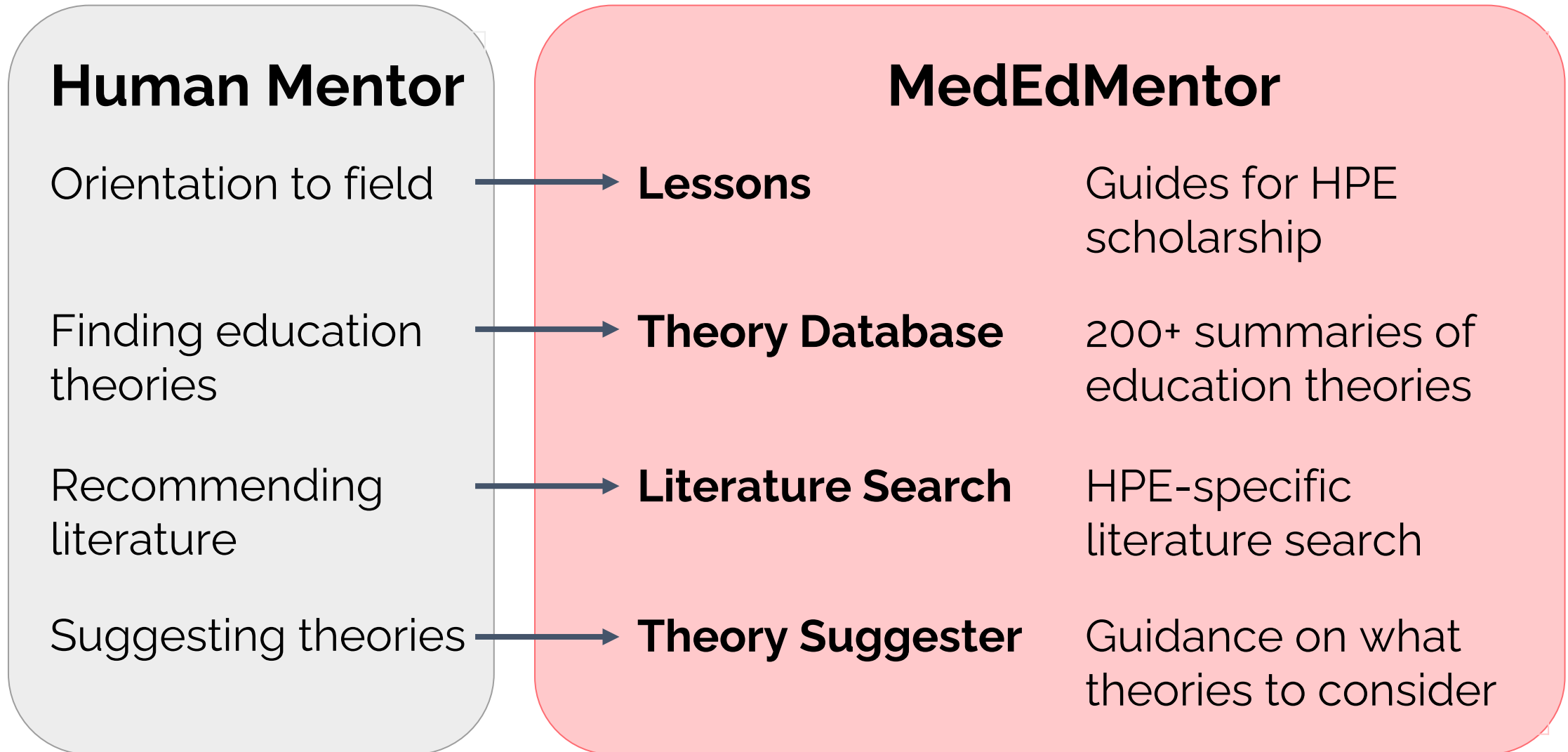


# MedEdMentor

- The digital mentor for HPE scholarship
- Our goal is to make HPE scholarship universally accessible
- Over 1750 users from 95+ countries use MedEdMentor



# Design based on the roles of a human mentor





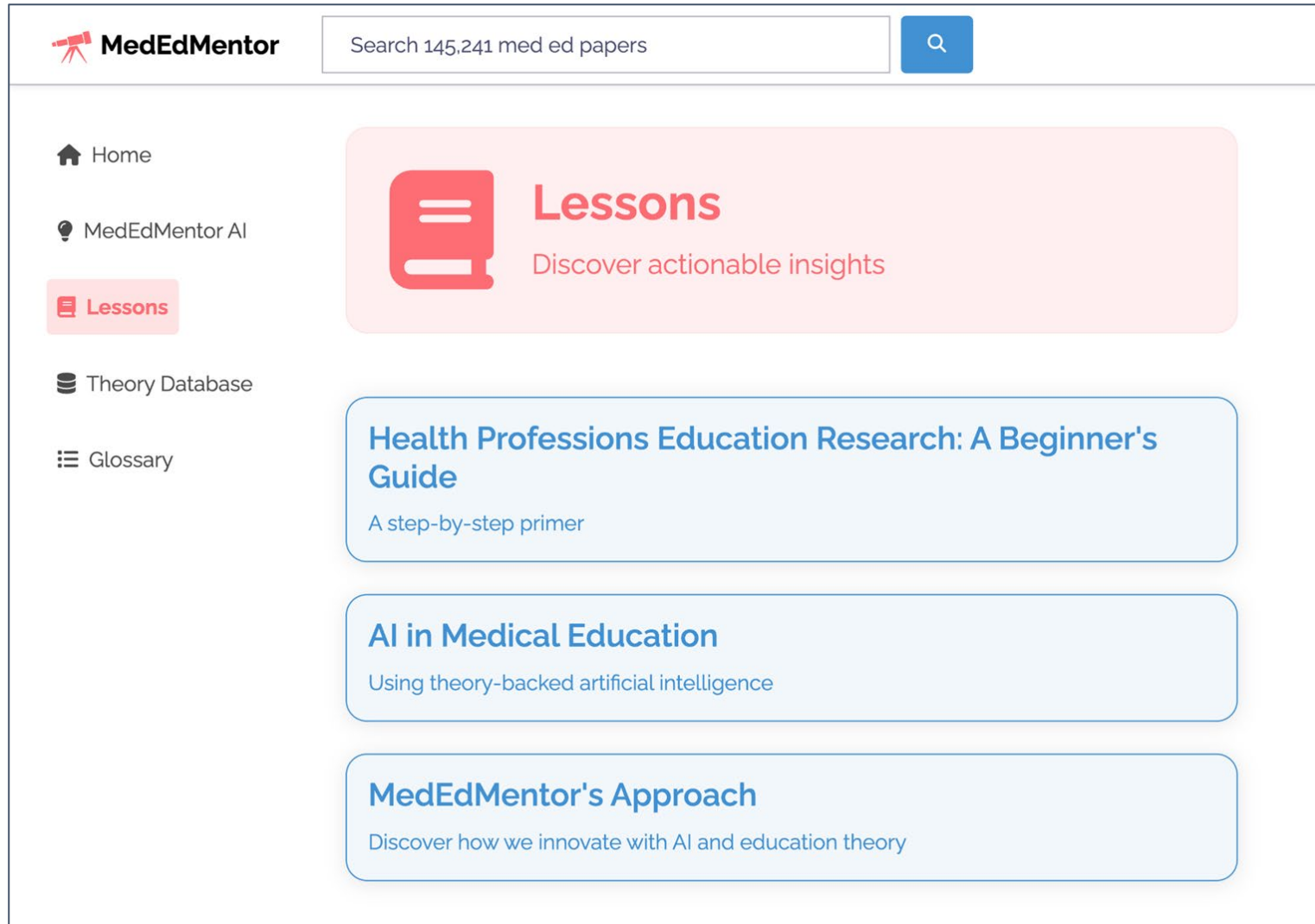
# Static Content



# Lessons



# Lessons



The screenshot displays the MedEdMentor website interface. At the top left is the MedEdMentor logo, which includes a red telescope icon. To its right is a search bar containing the text "Search 145,241 med ed papers" and a blue search button with a magnifying glass icon. A left-hand navigation menu lists several options: "Home" with a house icon, "MedEdMentor AI" with a lightbulb icon, "Lessons" with a red book icon and highlighted in a pink box, "Theory Database" with a database icon, and "Glossary" with a list icon. The main content area features a large pink banner for "Lessons" with a red book icon and the text "Discover actionable insights". Below this are three blue rounded rectangular boxes, each representing a lesson: "Health Professions Education Research: A Beginner's Guide" (A step-by-step primer), "AI in Medical Education" (Using theory-backed artificial intelligence), and "MedEdMentor's Approach" (Discover how we innovate with AI and education theory).

**MedEdMentor** Search 145,241 med ed papers

- Home
- MedEdMentor AI
- Lessons**
- Theory Database
- Glossary

**Lessons**  
Discover actionable insights



**Health Professions Education Research: A Beginner's Guide**  
A step-by-step primer

**AI in Medical Education**  
Using theory-backed artificial intelligence

**MedEdMentor's Approach**  
Discover how we innovate with AI and education theory



# Sample Lesson from MedEdMentor



- Home
- MedEdMentor AI
- Lessons**
- Theory Database
- Glossary

Lessons / Health Professions Education Research: A Beginner's Guide /

## Selecting and Applying Theories in Health Professions Education Research

How to perform this crucial task for health professions education scholarship

**Authors:** Geoffrey V. Stetson, MD  
**Editors:** Gregory Ow, MD

**Read Time:** 13 min

### Introduction

Previously, here at MedEdMentor, we have made [the value of theory](#) quite clear. With that groundwork established, how do we make theory part of our scholarship in a meaningful way? Well, I am glad you asked!

### Not all scholarship requires theory

I know! I know! We have hammered home the concepts of theory and frameworks. But, I need to clearly state: not *all* medical education work *requires* theoretical framing.

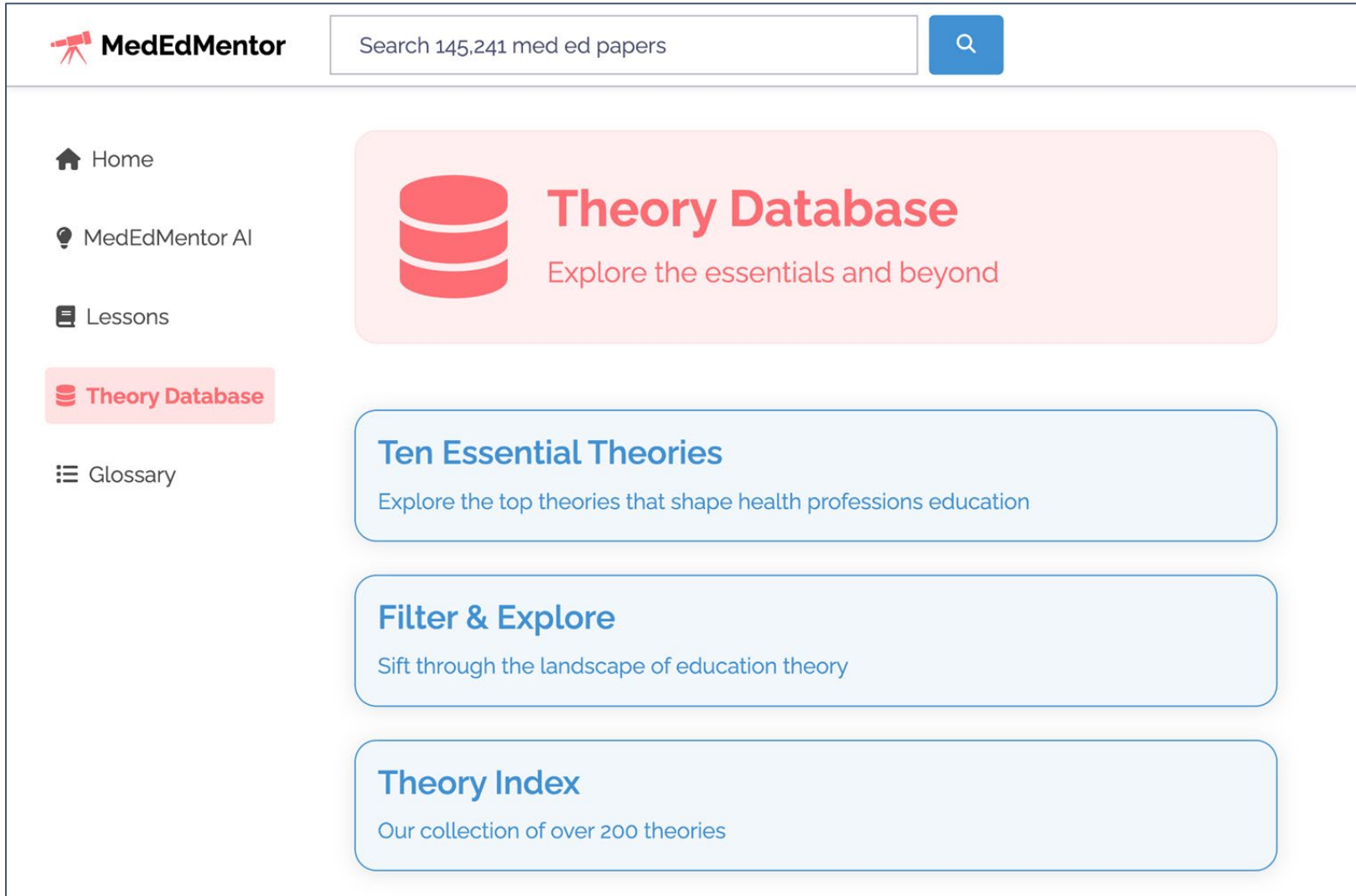
Examples of types of studies that don't require theory include:



# Theory Database



# Theory Database



The screenshot displays the MedEdMentor Theory Database website. At the top left is the MedEdMentor logo, which includes a red telescope icon. To its right is a search bar containing the text "Search 145,241 med ed papers" and a blue search button with a magnifying glass icon. A left-hand navigation menu lists several options: "Home" with a house icon, "MedEdMentor AI" with a lightbulb icon, "Lessons" with a document icon, "Theory Database" with a database icon and highlighted in a pink box, and "Glossary" with a list icon. The main content area features a large pink banner with a database icon and the text "Theory Database" and "Explore the essentials and beyond". Below this are three blue rounded rectangular buttons: "Ten Essential Theories" with the subtitle "Explore the top theories that shape health professions education", "Filter & Explore" with the subtitle "Sift through the landscape of education theory", and "Theory Index" with the subtitle "Our collection of over 200 theories".

**MedEdMentor** Search 145,241 med ed papers

- Home
- MedEdMentor AI
- Lessons
- Theory Database**
- Glossary

**Theory Database**  
Explore the essentials and beyond

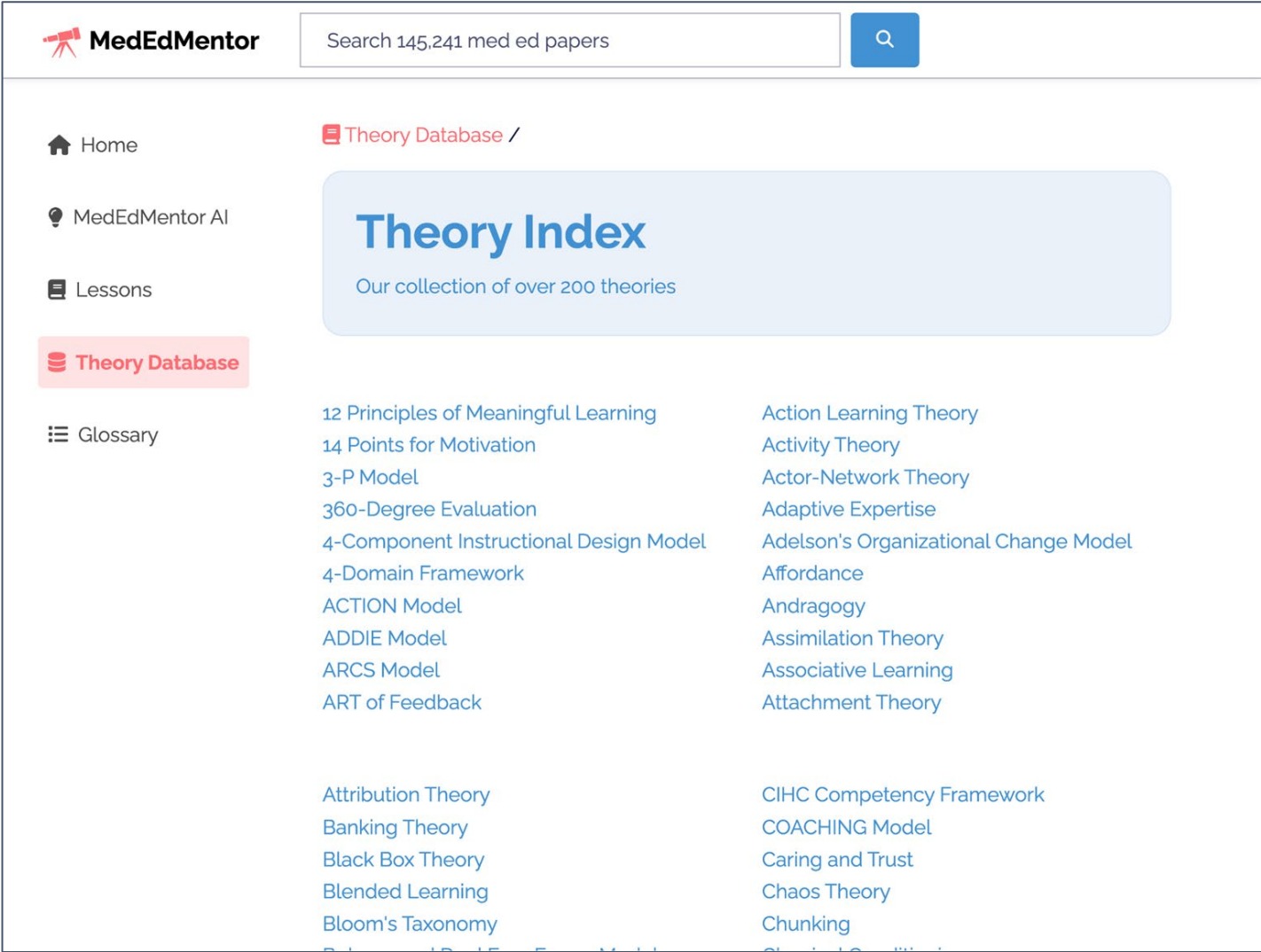
**Ten Essential Theories**  
Explore the top theories that shape health professions education

**Filter & Explore**  
Sift through the landscape of education theory

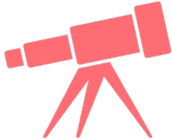
**Theory Index**  
Our collection of over 200 theories



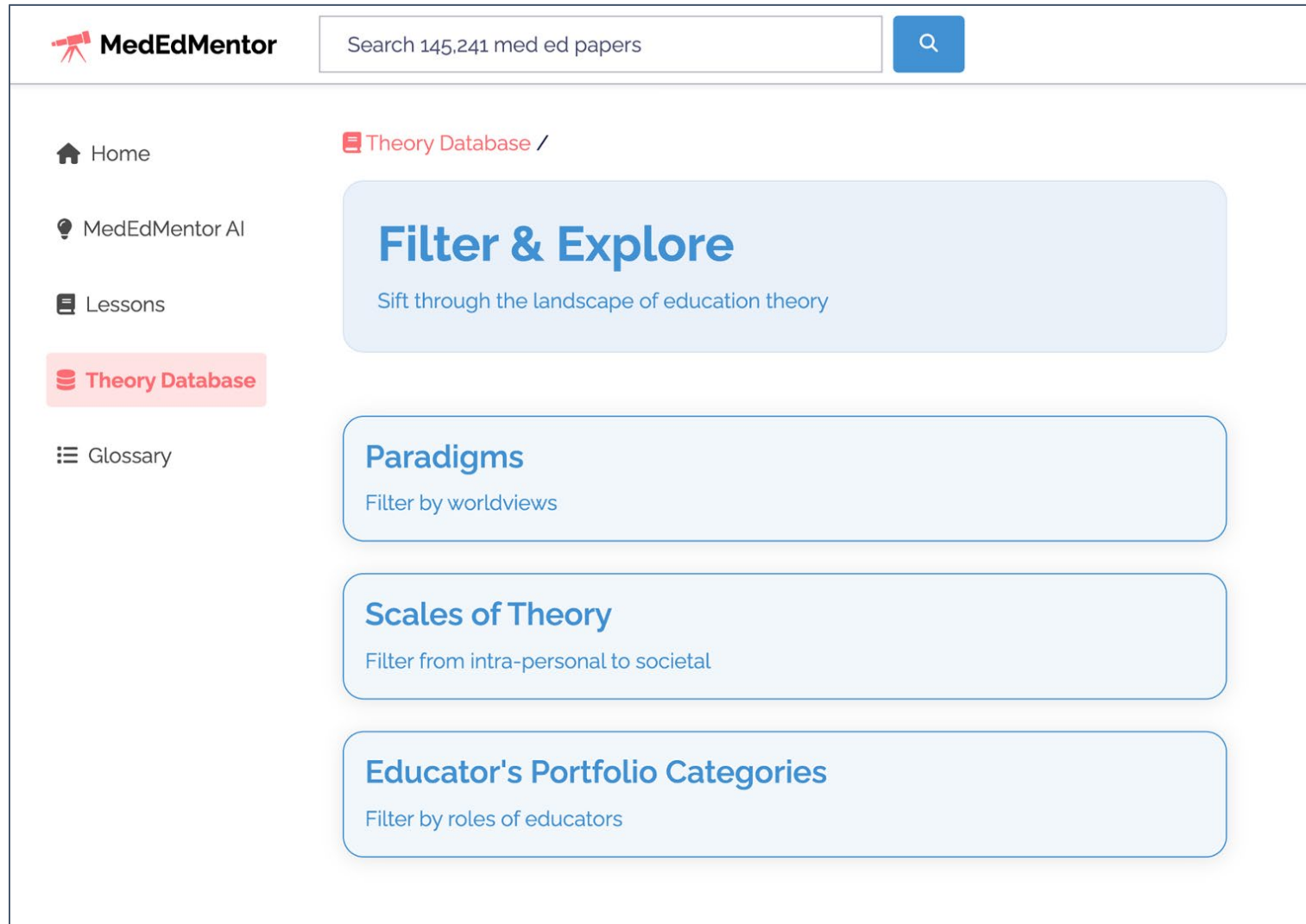
# Index of 200+ theories



The screenshot shows the MedEdMentor Theory Database interface. At the top left is the MedEdMentor logo. To its right is a search bar containing the text "Search 145,241 med ed papers" and a magnifying glass icon. Below the search bar is a navigation menu with the following items: Home, MedEdMentor AI, Lessons, Theory Database (highlighted in pink), and Glossary. The main content area is titled "Theory Database /" and features a large blue rounded rectangle with the text "Theory Index" and "Our collection of over 200 theories". Below this, a list of theories is displayed in two columns. The theories listed include: 12 Principles of Meaningful Learning, 14 Points for Motivation, 3-P Model, 360-Degree Evaluation, 4-Component Instructional Design Model, 4-Domain Framework, ACTION Model, ADDIE Model, ARCS Model, ART of Feedback, Attribution Theory, Banking Theory, Black Box Theory, Blended Learning, Bloom's Taxonomy, Action Learning Theory, Activity Theory, Actor-Network Theory, Adaptive Expertise, Adelson's Organizational Change Model, Affordance, Andragogy, Assimilation Theory, Associative Learning, Attachment Theory, CIHC Competency Framework, COACHING Model, Caring and Trust, Chaos Theory, and Chunking.



# Find theories by paradigm, scale, and more





The screenshot displays the MedEdMentor Theory Database interface. At the top left is the MedEdMentor logo, which includes a red telescope icon. To its right is a search bar containing the text "Search 145,241 med ed papers" and a blue search button with a magnifying glass icon. Below the search bar is a navigation menu on the left side with the following items: "Home", "MedEdMentor AI", "Lessons", "Theory Database" (highlighted in a pink box), and "Glossary". The main content area is titled "Theory Database /" and features four large, light blue rounded rectangular buttons stacked vertically. The first button is labeled "Filter & Explore" with the subtitle "Sift through the landscape of education theory". The second button is labeled "Paradigms" with the subtitle "Filter by worldviews". The third button is labeled "Scales of Theory" with the subtitle "Filter from intra-personal to societal". The fourth button is labeled "Educator's Portfolio Categories" with the subtitle "Filter by roles of educators".





# Theory Summaries



- Home
- MedEdMentor AI
- Lessons
- Theory Database**
- Glossary

[Theory Database](#) / [Theory Index](#) /

## Miller's Pyramid of Skill Development

nan

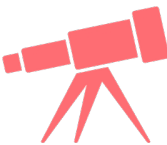
**Written:** February 13, 2022  
**Authors:** Michael Quinn, DO; T. Moadel, MD; Michael Cassara, D.O. MSED  
**Editors:** Geoffrey V. Stetson, MD

### Noted Theory Originators

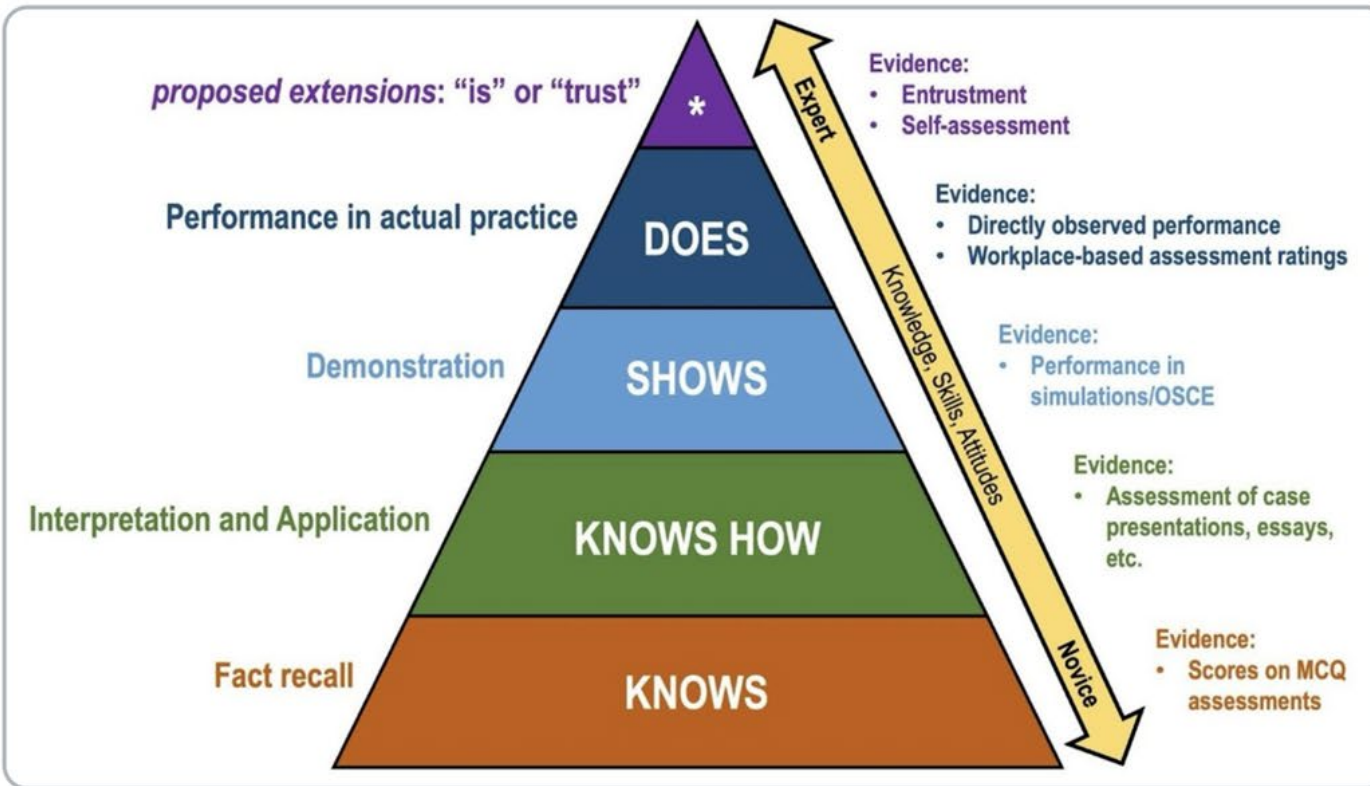
George Miller

### Summary

Miller's pyramid is a hierarchical framework for clinical skill assessment in which each tier of the pyramid indicates the level of the learner's skill development. Each subsequent tier indicates a higher level of clinical development and serves as a foundation for subsequent higher-level tiers. The base of the pyramid, and the most basic level of clinical assessment, "**knows**", assesses a learner's knowledge base of a particular subject and is commonly measured through objective tests. The next tier, "**knows how**", assesses a learner's competence i.e. their ability to apply their knowledge of a subject through data collection/analysis, and synthesis of management plans. The third tier, "**shows how**", assesses a learner's performance when in a clinical scenario with a patient. The highest tier, "**does**", ideally would assess a learner and their actions when functioning independently in clinical practice. Cruess, et al. (2016) argue that an additional tier and pinnacle of the pyramid should be "**is**", in which professional identity formation is valued as the pinnacle of clinical development. Ten Cate et al. (2021) propose an extension to fifth tier aligned with entrustment ("**trusted**").



# Example diagram from a Theory Summary



Original Diagram by Michael Quinn and Michael Cassara. Adapted from: Miller's pyramid of clinical competence. (n.d.). In The iDea Book. University of Saskatchewan. Retrieved February 16, 2022, from <https://openpress.usask.ca/ideabook/chapter/millers-pyramid-of-clinical-competence/>, based on Ramani & Leinster (2008); also includes extension ideas from Creuss et al. (2016) and ten Cate et al. (2021).



# Where the theory was described / applied

## Described In

1. Miller G. E. (1990). The assessment of clinical skills/competence/performance. *Academic Medicine: Journal of the Association of American Medical Colleges*, 65(9 Suppl), S63–S67. <https://doi.org/10.1097/00001888-199009000-00045>
2. Cruess, R. L., Cruess, S. R., & Steinert, Y. (2016). Amending Miller's Pyramid to Include Professional Identity Formation: *Academic Medicine*, 91(2), 180–185. <https://doi.org/10.1097/ACM.0000000000000913>
3. Ten Cate, O., Carraccio, C., Damodaran, A., Gofton, W., Hamstra, S. J., Hart, D. E., ... & Schumacher, D. J. (2021). Entrustment decision making: extending Miller's pyramid. *Academic Medicine*, 96(2), 199-204.
4. Ramani, S., & Leinster, S. (2008). AMEE Guide no. 34: teaching in the clinical environment, *Medical Teacher*, 30:4, 347-364. <https://doi.org/10.1080/01421590802061613>

## Applied In

1. Witheridge, A., Ferns, G., & Scott-Smith, W. (2019). Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. *International journal of medical education*, 10, 191–192. <https://doi.org/10.5116/ijme.5d9b.0c37>
2. Williams, B. W., Byrne, P. D., Welindt, D., & Williams, M. V. (2016). Miller's pyramid and core competency assessment: a study in relationship construct validity. *Journal of Continuing Education in the Health Professions*, 36(4), 295-299. [https://journals.lww.com/jcehp/fulltext/2016/03640/Miller\\_s\\_Pyramid\\_and\\_Core\\_Competency\\_Assessment\\_.11.aspx](https://journals.lww.com/jcehp/fulltext/2016/03640/Miller_s_Pyramid_and_Core_Competency_Assessment_.11.aspx)
3. Al-Eraky, M., & Marei, H. (2016). A fresh look at Miller's pyramid: assessment at the 'Is' and 'Do' levels. *Medical education*, 50(12), 1253-1257.



# Categorization of the theory & similar theories

## **Paradigm**

Interpretivist

Post-positivist

## **Educator's Portfolio Category**

Approaches to Teaching and Learning

Learner Assessment

Curriculum Development and Evaluation

## **Scale of Theory**

Individual

## **Similar Theories**

Dreyfus (Five-Stage) Model of Skill Acquisition, Peyton/Burch/Broadbent conscious-competence model, Bloom's Taxonomy, Competency-Based Education, Entrustable Professional Activities



# AI-Enhanced Features



# HPE-Specific Literature Search



# HPE-Specific Literature Search

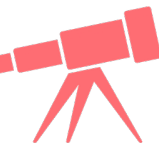
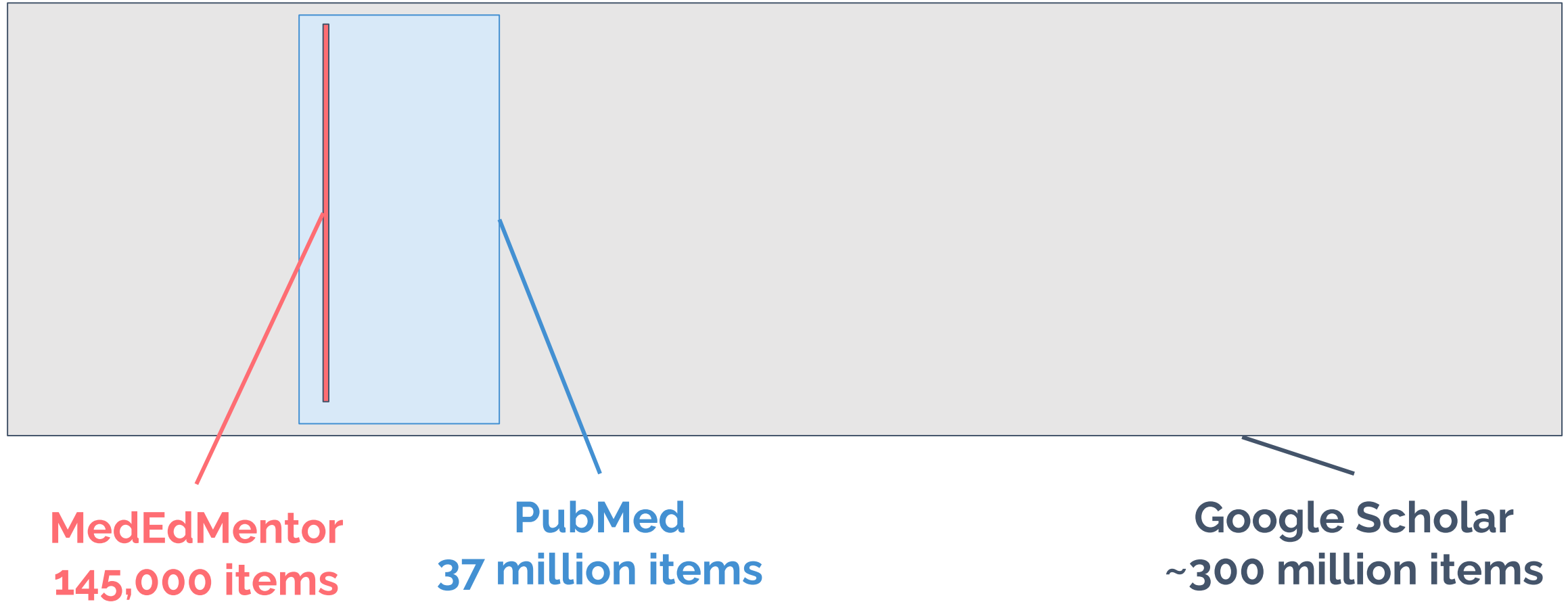


**MedEdMentor**

Search 145,241 med ed papers



# A much more focused search





# Let's search Google Scholar

Google Scholar

survey design medical education



Articles  Case law



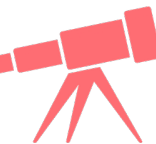
# Google Scholar Result #1 — ✓

Tracing the steps of **survey design**: a [PDF] alle  
graduate **medical education** research  
example

C Magee, G Rickards, L A. Byars... - ... **Medical Education**, 2013  
- meridian.allenpress.com

... the quality of GME **surveys** and increase the likelihood of  
collecting **survey** data with evidence ... in **medical education** may  
operationalize this framework with examples from a **survey** we ...

☆ Cited by 50 Related articles ⇨⇨



# Google Scholar Result #2 — ✓

What do our respondents think we're asking? Using cognitive interviewing to improve **medical education surveys** [PDF] alle

GB Willis, [AR Artino Jr](#) - ... of graduate **medical education**, 2013 - meridian.allenpress.com

... **medical education** (GME) educators and researchers to use more systematic and rigorous **survey design** ... a 6-step decision process for questionnaire **designers** to use. In this article, we ...

☆ Cited by 561 Related articles ⇨⇨



# Google Scholar Result #3 — ✓

You can't fix by analysis what you've [PDF] alle  
spoiled by **design**: developing **survey**  
instruments and collecting validity evidence

G Rickards, C Magee... - ... **medical education**, 2012 -  
meridian.allenpress.com

... or best practices in **survey design**.<sup>2</sup> As a result, the reliability  
and validity of many **medical education surveys** are uncertain.  
When **surveys** are not well **designed**, the data obtained from ...

☆ Cited by 247 Related articles ⇨⇨



# Google Scholar Result #4 — Not quite

## National **survey** on anatomical sciences in **medical education**

[PDF] Wiley

JM McBride, RL Drake - Anatomical sciences **education**, 2018 - Wiley Online Library

... **medical** schools wishing to gain or maintain accreditation through the Liaison Committee on **Medical Education** ... After a review of LCME decisions on full **survey** reports from 2004–2012,

...

☆ Cited by 243 Related articles ⇨⇨



# Now, an HPE-Specific Literature Search



**MedEdMentor**

survey design



# MedEdMentor Result #1, #2 — ✓

## Survey research design: Questionnaire development

Michael J. Peeters , K. Janke - Currents in Pharmacy Teaching and Learning - 2022

## Educator's blueprint: A how-to guide for survey design

Jeffery Hill , K. Ogle , S. Santen , M. Gottlieb , A. Artino - AEM Education and Training

**Abstract** Surveys are ubiquitous in medical education. They can be valuable for assessment across a wide ... [Expand](#)



# MedEdMentor Result #3 — ✓

## Tracing the steps of survey design: a graduate medical education research example

Charles Magee , G. Rickards , Lynn A Byars , A. Artino - Journal of Graduate Medical Education - 2013

**tldr** This article illustrates how researchers in medical education may operationalize a framework for developing survey instruments with examples from a survey developed for the recent integration of 2 independent internal medicine residency programs.

[Expand](#)





# MedEdMentor Result #4, #5 — ✓

## Mastering Survey Design and Questionnaire Development.

Meigan Robb , T. Shellenbarger - Journal of Continuing Education in Nursing: Continuing Competence for the Future - 2020

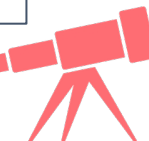
**tldr** Individuals creating surveys should follow survey design and item development guidelines, such as those described in this article, to ensure the accuracy of the data gathered

[Expand](#)

## Lies, Damned Lies, and Surveys.

A. W. Phillips , A. Artino - Journal of Graduate Medical Education - 2017

**Abstract** Surveys are a common research method used in medical education. For example, retrospective ... [Expand](#)



# Different # of results $\Rightarrow$ different purposes

## Google Scholar

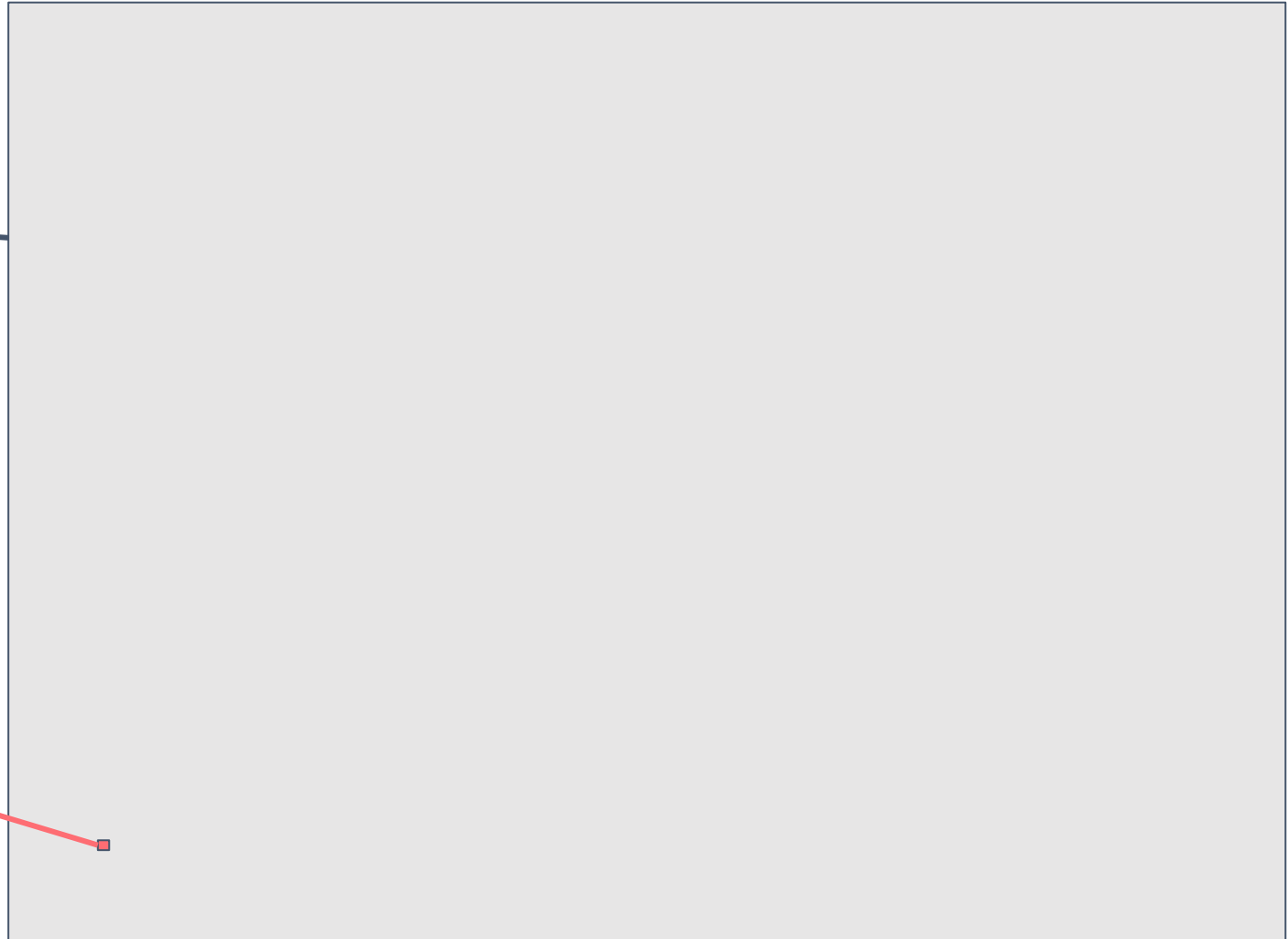
5,940,000 results

Ideal for broad,  
thorough searches

## MedEdMentor

40 results

Ideal for focused  
overviews



# Theory Suggester



# Enter a phenomenon into Theory Suggester

## Theory Suggester

Use AI to suggest education theories for your research

### Research phenomenon:

teaching medical student oral presentation skills

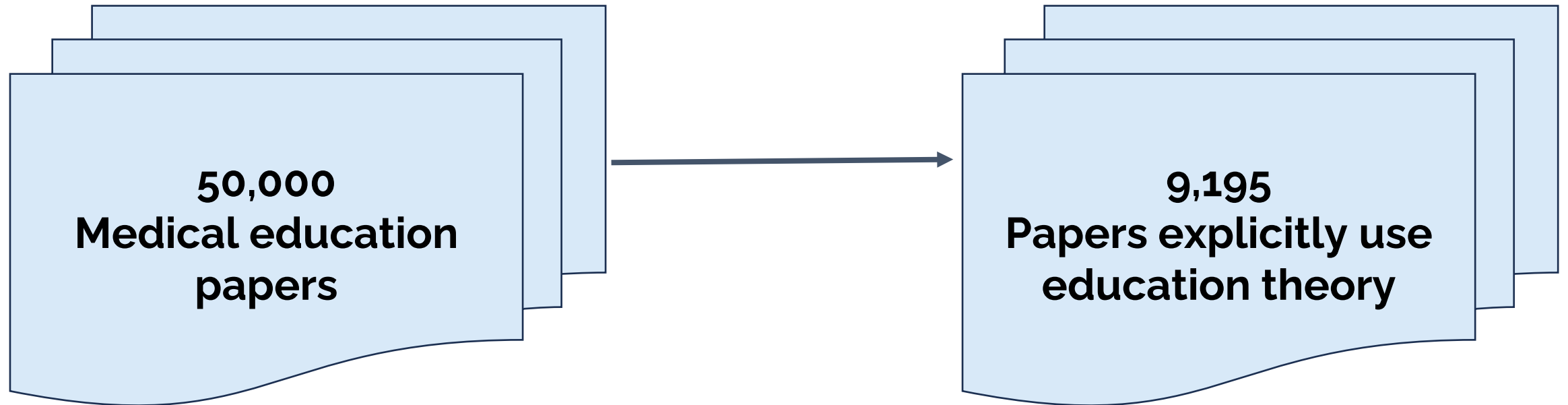
**Submit**

Free while in testing.

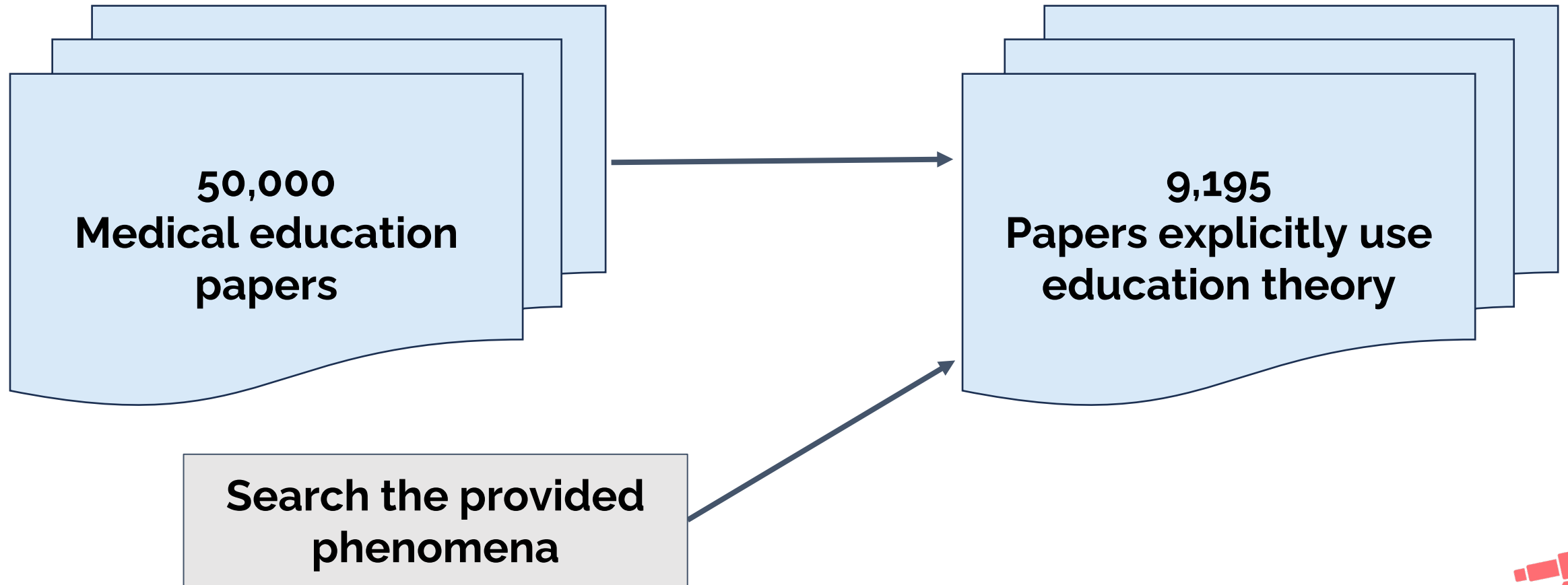
Powered by MedEdMentor AI.



# Then MedEdMentor finds relevant theories



# Then MedEdMentor finds relevant theories



# Receive a list of theories to consider



Here are some theories for you to consider:

- Experiential Learning Theory - 3 papers
- Rhetorical Theory - 2 papers
- Genre Knowledge - 2 papers
- Active Learning Theory - 2 papers
- Feedback Theory - 2 papers
- Deliberate Practice Theory - 1 paper
- Social Learning Theory - 1 paper
- Formative Assessment - 1 paper
- Hidden Curriculum Theory - 1 paper
- Sociolinguistic Theory - 1 paper
- Effective Communication Theory - 1 paper
- Role Theory - 1 paper

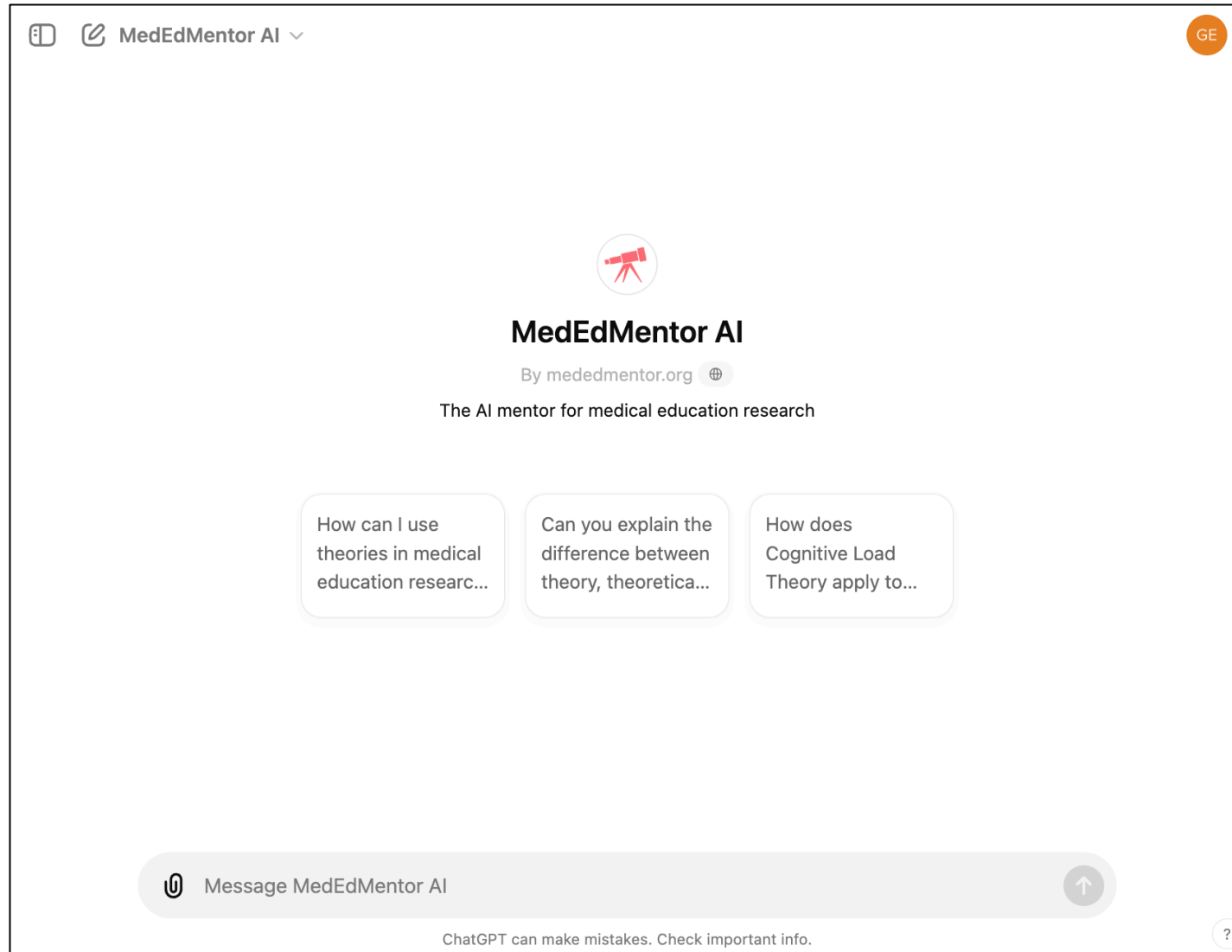


# MedEdMentor AI





# MedEdMentor AI



The screenshot shows a chat interface for MedEdMentor AI. At the top left, there is a tab labeled "MedEdMentor AI" with a dropdown arrow. In the top right corner, there is a circular orange button with the letters "GE". The main content area features a red telescope icon in a circle, followed by the text "MedEdMentor AI" and "By mededmentor.org" with a globe icon. Below this is the tagline "The AI mentor for medical education research". Three example prompts are displayed in rounded rectangular boxes: "How can I use theories in medical education researc...", "Can you explain the difference between theory, theoretica...", and "How does Cognitive Load Theory apply to...". At the bottom, there is a text input field with the placeholder "Message MedEdMentor AI" and a send button with an upward arrow. A small disclaimer at the bottom center reads "ChatGPT can make mistakes. Check important info." and a help icon (question mark) is in the bottom right corner.

MedEdMentor AI

By mededmentor.org

The AI mentor for medical education research

How can I use theories in medical education researc...

Can you explain the difference between theory, theoretica...

How does Cognitive Load Theory apply to...

Message MedEdMentor AI

ChatGPT can make mistakes. Check important info.



# MedEdMentor is meeting a global need

High organic usage:

1750 Users

13,000 Minutes

1,000 Suggestions

5,000 Searches

95 Countries

MedEdMentor is meeting a global need for  
accessible mentorship



# Next, more mentorship domains in progress

## Human Mentor

Recommending literature

Writing research questions

Suggesting methodologies

Networking

Moral support

## MedEdMentor

Expand paper database to other HPE fields

Offer critiques for research questions

Methodology Suggester

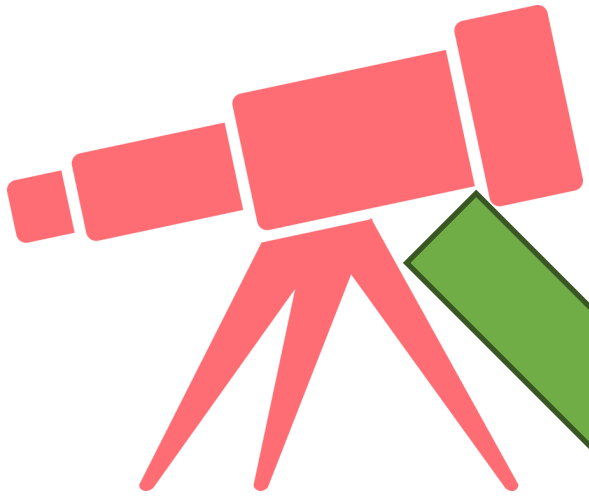
Community of Practice

Project reminders and encouragement

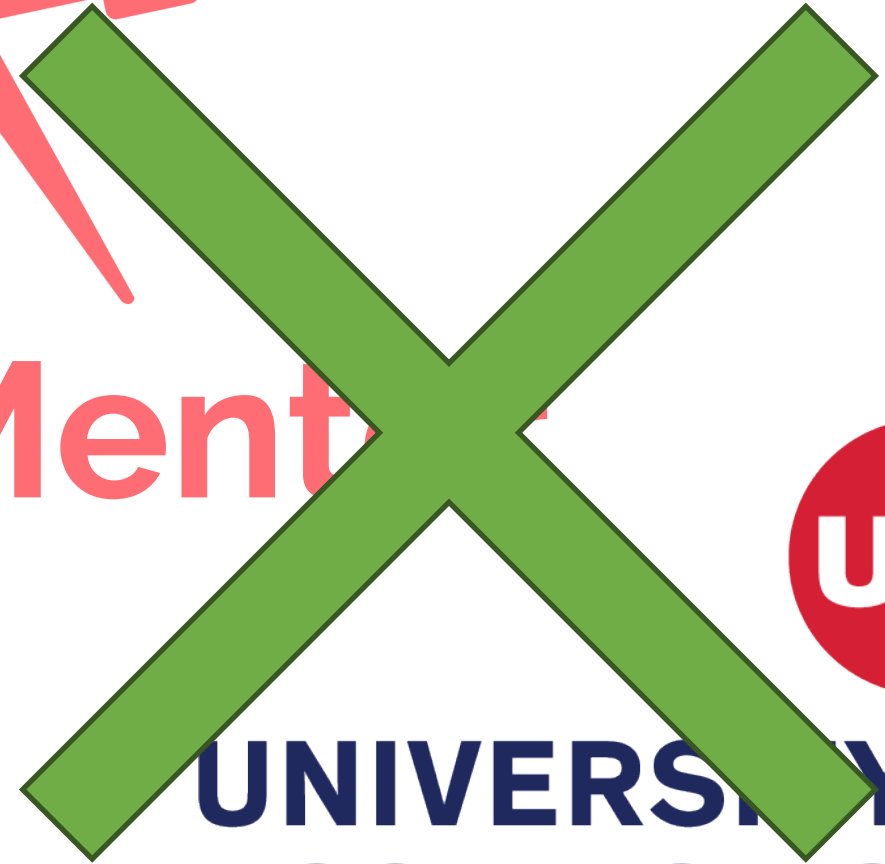


# Partnership, Collaboration, and Support

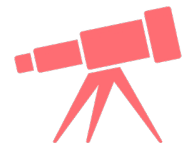




MedEdMentor



**UNIVERSITY OF ILLINOIS  
COLLEGE OF MEDICINE**

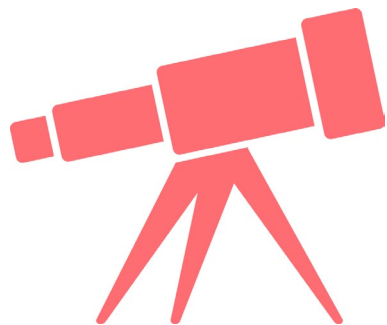


# Implications of no partnership

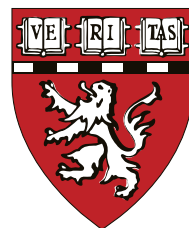
- All MedEdMentor business after-hours
- Academic caveats
- No university resources
  - No students, residents, fellows, graduate students
  - No collaboration with colleagues



# Budding Collaboration



**MedEdMentor**



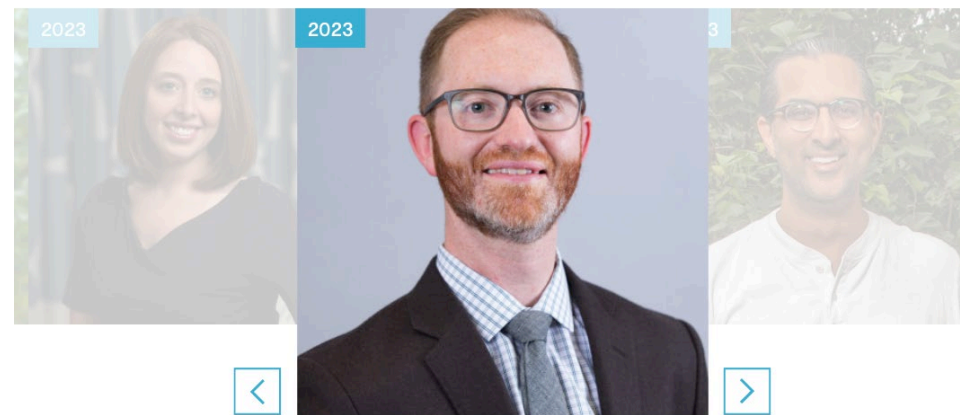
**HARVARD  
MACY INSTITUTE**  
HARVARD MEDICAL SCHOOL



# Support from Macy Foundation



## Meet Our Scholars



**Geoff Stetson, MD**

UNIVERSITY OF ILLINOIS CHICAGO COLLEGE OF MEDICINE

[VIEW PROFILE](#)

Geoff Stetson is an Associate Professor of Clinical Medicine and Medical Education at the University of Illinois Chicago (UIC) College of Medicine. Until 2022, Dr. Stetson worked at the University of California San Francisco.

Through his role as Director of Clinical Faculty Development at UIC, Dr. Stetson works to optimize learning in clinical environments with an emphasis on diversity and inclusion. Additionally, he is an expert in technology-enhanced education.

Dr. Stetson's Macy Faculty Scholars project investigates how master researchers in health professions education utilize theoretical frameworks and make them accessible to mentees. Lessons learned will inform the creation and study of an interactive website for novice scholars from diverse backgrounds, geographies, and institutions, to foster scholarship, mentorship, and community. You can find that website at: [www.MedEdMENTOR.org](http://www.MedEdMENTOR.org).

Alan Schwartz, PhD, the Michael Reese Endowed Professor of Medical Education in the Department of Medical Education at the UIC College of Medicine, serves as Dr. Stetson's mentor.





**Thank you!**



**MedEdMentor.org**



# HDSI



Harvard Data  
Science Initiative

## **BUILDING AI PARTNERSHIP ACROSS MEDICINE, INDUSTRY, & GOVERNMENT: Lessons Learned from the Harvard Data Science Initiative**



The Harvard Data Science Initiative is a **Harvard-wide initiative** that connects and galvanizes Harvard's data science ecosystem **to make meaningful progress on issues of societal impact.**

# CONTEXT – ABOUT THE HARVARD DATA SCIENCE INITIATIVE

## CHALLENGE:

DATA SCIENCE EXISTS IN  
ALL SPACES AT HARVARD

SINCE LAUNCHING IN  
2017, OUR COMMUNITY  
HAS GROWN TO INCLUDE:

- 160+ FACULTY MEMBERS
- 10 HARVARD SCHOOLS
- 13 RESEARCH CENTERS

### DEPARTMENTS AND AREAS:

Applied Math (SEAS)  
Astronomy (FAS)  
Bioengineering (SEAS)  
Biomedical Informatics (HMS)  
Biostatistics (SPH)  
Computer Science (SEAS)  
Design (GSD)  
Earth and Planetary Sciences (FAS)  
Economics (FAS)  
Education (GSE)  
Electrical Engineering (SEAS)  
Environmental Health (SPH)  
Epidemiology (SPH)  
Global Health and Pop (SPH)  
Global Health Social Med (HMS)  
Government (FAS)  
Health Care Policy (HMS)  
International Dev (HKS)  
Law/International Law (HLS)  
Marketing (HBS)  
Mathematics (FAS)  
Molecular and Cell Biology (FAS)  
Nutrition (SPH)  
Physics (FAS)  
Psychiatry (HMS)  
Psychology (FAS)  
Public Policy (HKS)  
Romance Languages (FAS)  
Sociology (FAS)  
Statistics (FAS)  
Tech and Operations Mgmt (HBS)

### CENTERS AND PROGRAMS:

Berkman Klein Center for Internet & Society (HLS)  
Boston Area Research Initiative (Harvard/NEU)  
Center for Geographic Analysis (CGA)  
Center for Intl Development (HKS)  
Center for Research on Computation and Society (SEAS)  
Center on the Legal Profession (HLS)  
CrisisReady.io (SPH/HMS)  
Digital, Data, and Design (D<sup>3</sup>) Institute (HBS)  
Harvard Business Analytics Program

(HBS/SEAS)  
Institute for Applied Computational Science (SEAS)  
Institute for Quantitative Social Science (FAS)  
metaLab (FAS/GSD)  
Wyss Institute (SEAS/HMS)



**HDSI FACULTY  
DIRECTOR**  
Francesca  
Dominici  
(Biostatistics)



**HDSI FACULTY  
CO-DIRECTOR**  
Stratos Idreos  
(Computer  
Science)

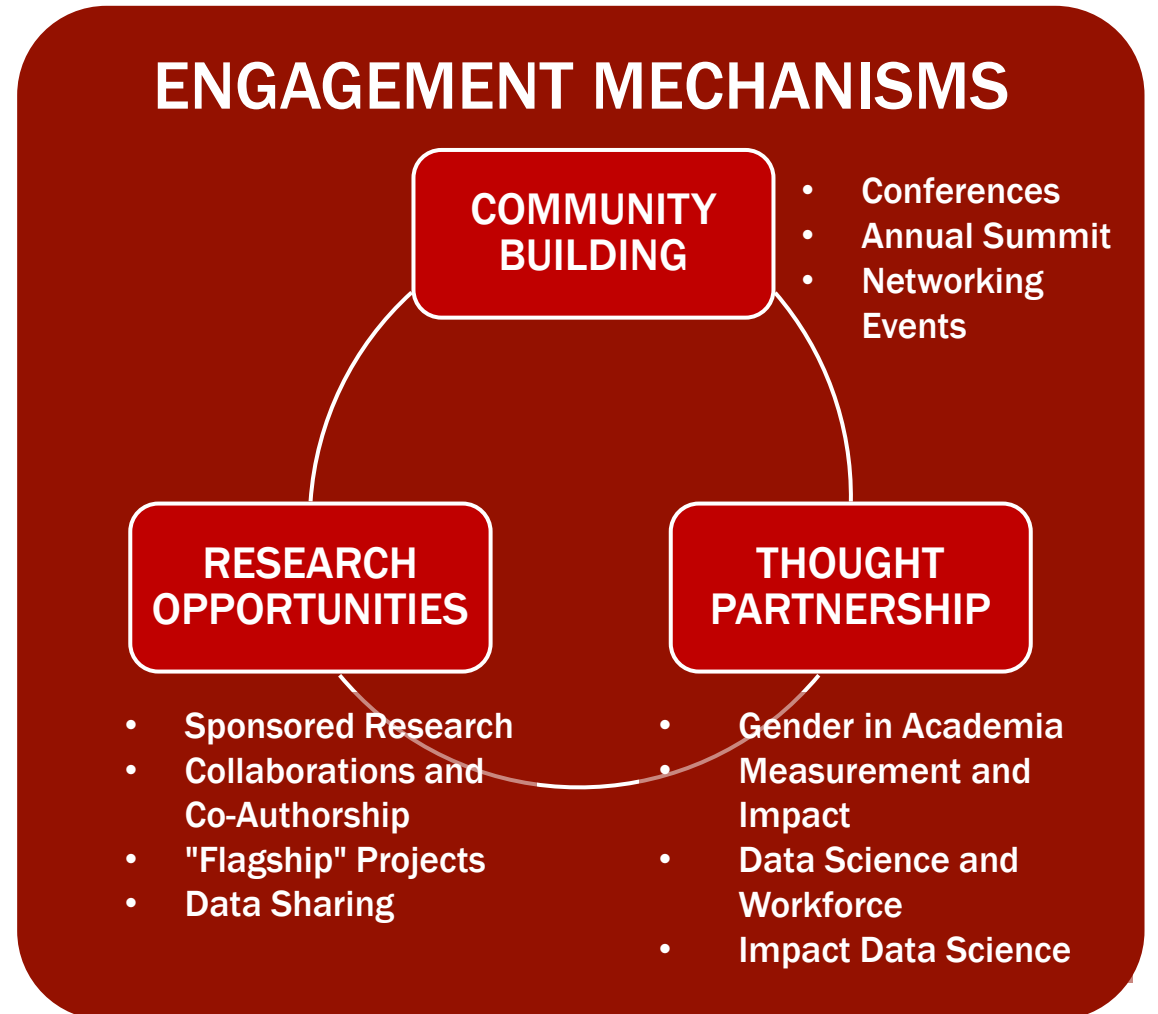
# WHY DO WE INTERACT WITH INDUSTRY?

## VALUE TO ACADEMIA:

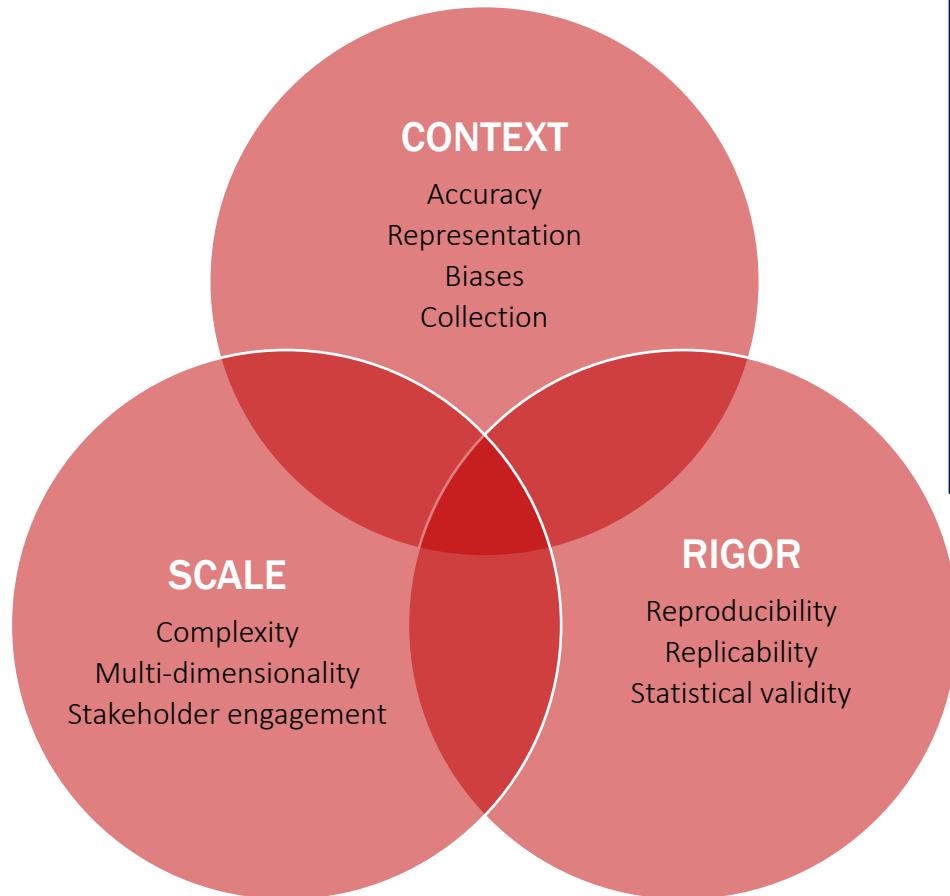
- Industry is innovating data science and AI in real time, at scale
- Amplify impact of academic research
- Research resources and support

## VALUE TO INDUSTRY:

- Workforce / hiring / access to talent
- Executive education / continuing education
- Collaborative research / thought partnership
- Branding



# HDSI WORKS WITH INDUSTRY ON URGENT, PRE-COMPETITIVE TOPICS



Harvard and Elsevier are using data science to improve gender equality in academia  
January 16, 2020



Colleagues from Harvard  
data science project  
in academia

Harvard Data Science Initiative  
Announces the AWS Impact  
Computing Project at the HDSI  
November 8, 2022



New alliance between Harvard Data Science Initiative and Amazon Web Services set to transform how faculty use data to solve the world's biggest problems.

Bayer to support Harvard Research Study to Evaluate Trust in Science, Including in COVID-19 pandemic  
May 26, 2020



Image Courtesy of Bayer

With seed funding from Bayer, Harvard  
launches a research effort

HDSI Corporate Members Workshop - Data Science and Our Workforce

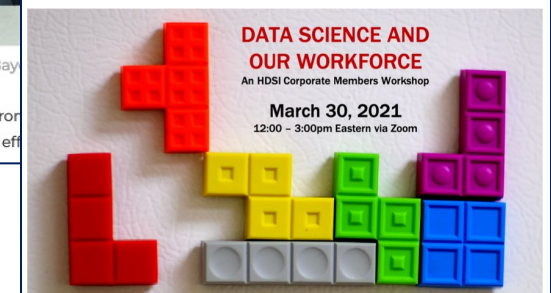


Image Credit: Aldo Gonzalez

ABOUT

With the continued growth of predictive analytics and ever increasing access to data, both structured and unstructured, we see new opportunities and challenges for understanding workforce dynamics. How can data science methods be used in recruitment? What can data science tell us about teams and team members? How should we approach performance metrics while remaining sensitive to human elements? How do we achieve a diverse and inclusive workforce? And, for all of the above, what are the limitations and biases of a quantitative approach and how do we overcome them? Are there places where a quantitative approach is never appropriate? In this half-

# QUESTIONS TO ASK

## WHY?

- What is valuable about collaboration?
- Is it tangible or intangible?
- Who decides?

## HOW?

- Know what mechanisms are available: sponsored research, philanthropy, something else?
- How to decide?
- How will you incentivize faculty?

## WHO?

- What is the administrative cost of managing the collaboration?
- Who are your champions on either side? How will they help unstick challenges?

## WHAT?

- Define, define, define.
- “What does that mean?”

## WHEN?

- The agreement is only the beginning.
- How will you sustain momentum?

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SCIENCE & TECHNOLOGY

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Harvard Data Science Initiative, Amazon Web Services join to boost research, unlock solutions to health, climate, economic challenges

### WHY?

- Using HPC to overcome roadblocks for data-driven solutions
- First-hand experience in building workflows and pipelines

### HOW?

- Faculty research - sponsored
- Field-building and education - philanthropy

### WHO?

- Alliance management
- Our internal stakeholders - Vice Provost for Research, Tech Development, Fundraising (Development), General Counsel

### WHAT?

- Ongoing communication
- Getting to know corporate culture

### WHEN?

- Entering Year 3.
- Continued connection – advisory groups, events, etc.



# GETTING STARTED - KEY TAKEAWAYS



1. Industry relations requires an investment in resources (PEOPLE!)
2. If you can, start local. Who is in your region?
3. Communication, communication, communication!

# Thank you!

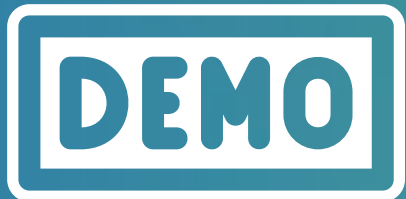
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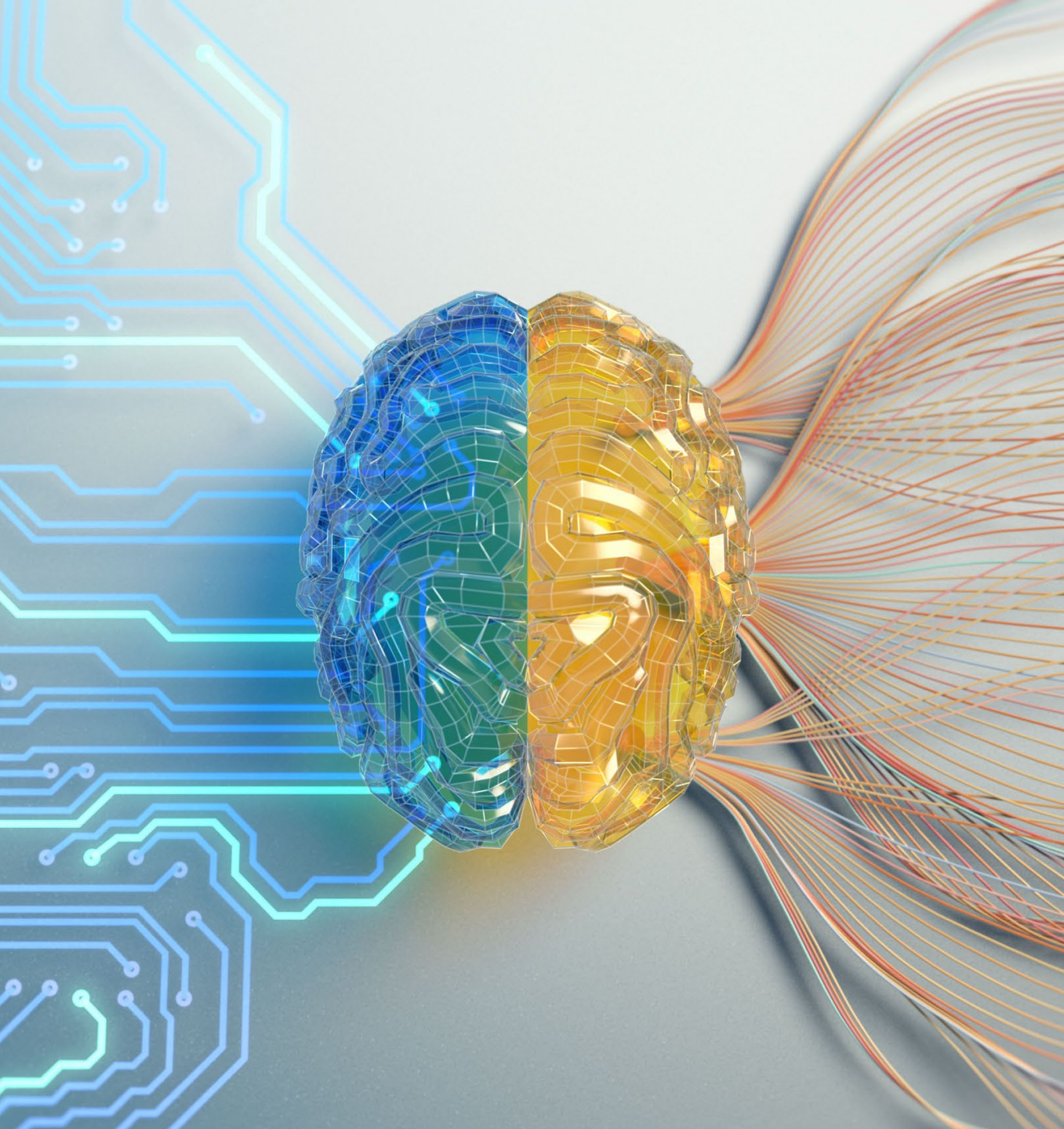
Save the Date: Feb. 5-6, 2025

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Selected presenters will demonstrate innovative ways that educational technology can support teaching and learning in HPE.



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- *Video recording*
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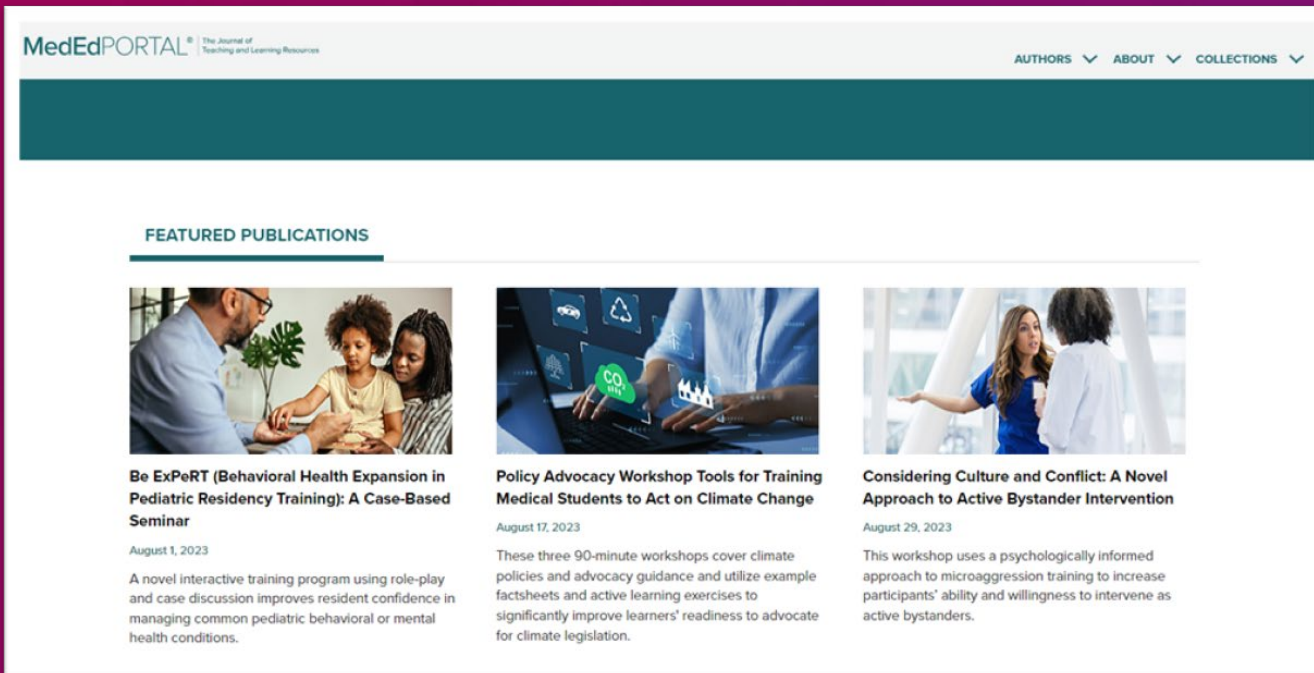
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The screenshot shows the MedEdPORTAL website homepage. At the top left is the logo "MedEdPORTAL® The Journal of Teaching and Learning Resources". To the right are navigation links: "AUTHORS", "ABOUT", and "COLLECTIONS". Below the navigation is a dark teal horizontal bar. Underneath is a section titled "FEATURED PUBLICATIONS" with three articles:

- Be ExPeRT (Behavioral Health Expansion in Pediatric Residency Training): A Case-Based Seminar**  
August 1, 2023  
A novel interactive training program using role-play and case discussion improves resident confidence in managing common pediatric behavioral or mental health conditions.
- Policy Advocacy Workshop Tools for Training Medical Students to Act on Climate Change**  
August 17, 2023  
These three 90-minute workshops cover climate policies and advocacy guidance and utilize example factsheets and active learning exercises to significantly improve learners' readiness to advocate for climate legislation.
- Considering Culture and Conflict: A Novel Approach to Active Bystander Intervention**  
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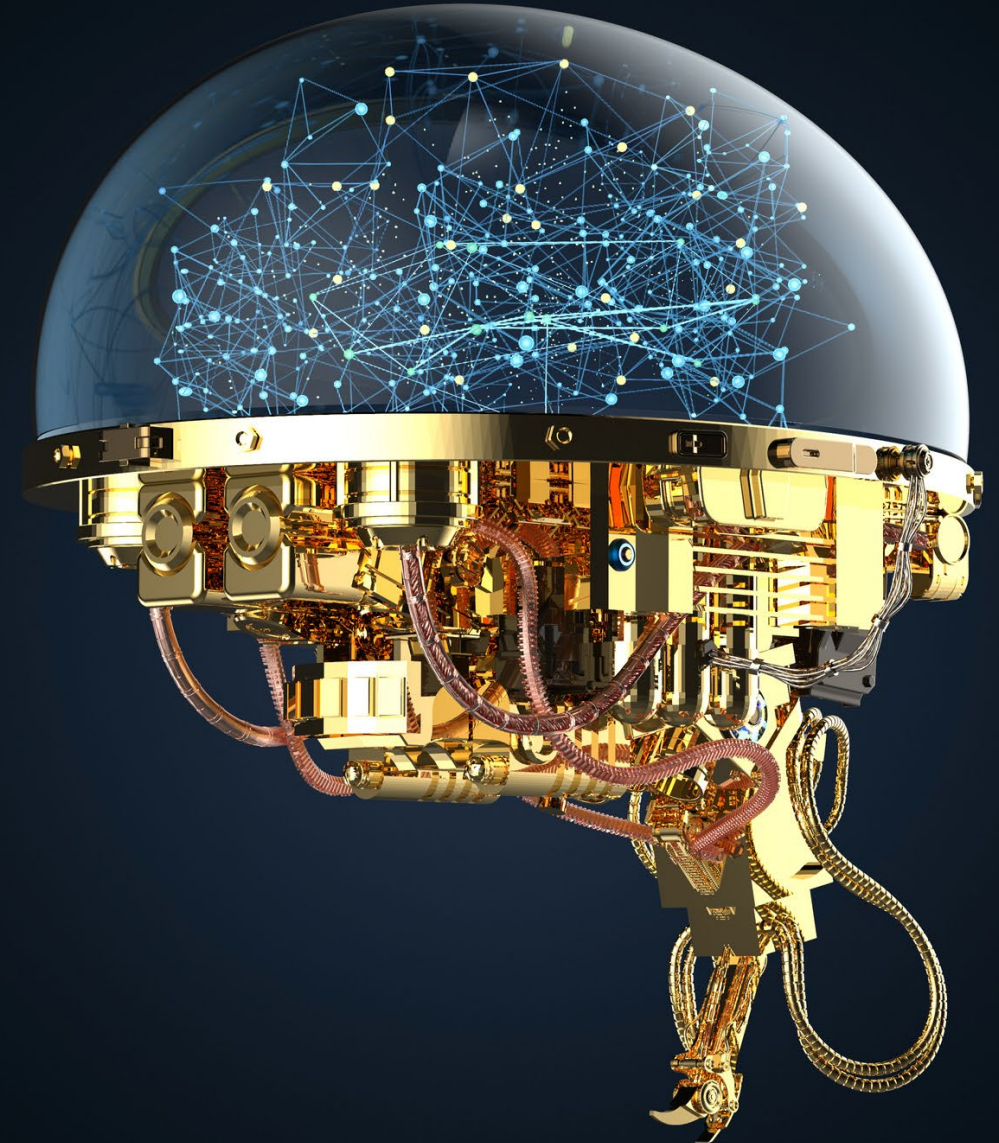
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