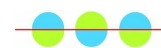# AI Workshop: Strategies to Train and Engage Students In Artificial Intelligence

Evaluation Report Completed

by
MN Associates, Inc.

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AI Workshop: Strategies to Train and Engage Students In Artificial Intelligence

Introduction

Fayetteville State University in North Carolina completed its second year of implementation of the HBCU-UP award, Targeted Infusion Project: Developing Geospatial Data Analytics Certificate Program (Award No. #1818694). In early spring, in discussion with the NSF program officer, Dr. Sambit Bhattacharya, the PI of the grant requested and received additional funding to host a week-long workshop. The virtual workshop titled, "Strategies to Train and Engage Students In Artificial Intelligence" (hereafter, AI Workshop) brought together over 40 educators and industry professionals from across the state of North Carolina to learn to use new tools and strategies to teach AI to their students. It was held on July 20-24. There were three main goals of the AI workshop:

Goal #1: Provide tools and training strategies to participants as take-aways

Pedagogy–teaching methods that extend inquiry-based and project- based approaches and how they integrate computer coding in teaching methods

Technology–computing resources and how to compute

Cloud computing--ready access to AI computing resources

Programming in Python and R–concept to implementation

Goal #2: Gain an understanding of the frontier of AI knowledge–problems & benefits

Keynote address 1 by Emily Hand, Ph.D. --AI Ethics, Innovation, and Accessibility

Keynote address 2 by Kathleen Featheringham --Demystifying AI-What is Data Science, Machine Learning, and Artificial Intelligence?

Keynote address 3 by Sudipta Dasmohapatra, Ph.D. --Trends in Data Science: Education, Research, and Practice

Goal #3: Support ongoing K-16 collaborations and seek new funding from federal agencies

School, college, university, and industry

Share excitement of AI in multidisciplinary and multi-institution collaborations

Seeking support from funding agencies such as NSF, NASA, DoE, DoD, and others

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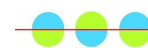
Background

As part of dissemination activities of the ongoing TIP grant and as a preparation for the AI workshop, the PI and Co-PIs have conducted a series of lectures at various institutions within the University of North Carolina (UNC) System including: Winston Salem State University (WSSU), Elizabeth State University (ECSU), NC A&T State University (NCAT), and UNC Pembroke (UNCP). Their lectures were attended by both faculty and students from Engineering disciplines and Sciences including Geosciences. Additionally, the PI and Co-PIs conducted phone conversations with school superintendents of Cumberland county (where Fayetteville is located) and the adjacent Bladen and Hoke Counties that are primarily rural and underserved counties of the state.

As a follow up to the visits and conversations, an online survey to assess the need and format of a summer workshop was sent out to university departments and county schools. A total of 39 responses were recorded. One of the questions in the survey asked respondents to write an open response to the question: What content would be most interesting in a workshop? The most common response (above 70%) was Artificial Intelligence (AI). The respondents indicated that they are interested in discussing how to educate underrepresented students, students from underserved areas such as rural and/or remote communities, and first-generation college-enrolled students, to help prepare them for future education and the STEM workforce.

Furthermore, topics similar to what was suggested by the survey responses are being discussed at international meetings like the AAAI 2020 Workshop on Diversity in Artificial Intelligence. AI researchers and educators are addressing the discrepancy in the quality of education worldwide, including AI education. Numerous barriers prevent students from acquiring AI skills. Underserved communities typically lack resources—equipment such as computers among other tools. Adequate supply of equipment is a challenge, including limited physical space for hands-on AI activities like robotics and distributed sensing for decision making. Other challenges are lack of enough trained instructors qualified to teach AI with qualified members leaving underserved communities in search of better opportunities. Because of these reasons, most underserved communities face critical challenges in educating local students in AI.

AI Workshop

Agenda

The AI workshop held on July 20-24 brought together over 40 individuals that included: K-12 educators, faculty from community colleges and university and industry professionals to address the above mentioned local challenges in STEM education and help set a roadmap for future education and workforce

training efforts by the PI and Co-PIs at FSU and beyond.

Although, initially, the PI and Co-PIs wanted to conduct a blended workshop with in-person, synchronous, and asynchronous activities and sessions, however, as the COVID situation got serious and campuses began to shut down in mid-March/early April, they switched to an entirely virtual workshop. The general format of the workshop was as follows (Table 1). A full agenda is in Appendix.

Table 1: AI Strategies Workshop Agenda, July 20-24

JULY 20, 2020	JULY 21, 2020	JULY 22, 2020	JULY 23, 2020	JULY 24, 2020
Keynotes Collaboratory AI POGIL Demo AI Programming	Three hours of small group hands-on workshop on AI and teaching methods	Three hours of small group hands-on workshop on AI and teaching methods	Three hours of small group hands-on workshop on AI and teaching methods	Keynote Panel Discussion Town Hall Group Presentations

Workshop Organization

The organizing committee comprised PI, Dr. Sambit Bhattacharya, who was supported by Co-PIs, Drs. Bogdan (Denny) Czejdo and Valentin Milanov, an administrative staff member, a research technician/assistant, and three graduate-level students.

POGIL

The PI and Co-PIs used the Process Oriented Guided Inquiry learning (POGIL) teaching technique to facilitate as well as demonstrate the methodology during the Days 2-4 hands-on sessions on Regression, Decision Tree, and Artificial Neural Networks.

POGIL is a structured approach that requires participants to work in self-managed or regulated teams to explore content, ask questions, solve problems, conduct analysis, record the proceedings, and cooperate to draw valid conclusions. Using Google Colab (hosted by Jupyter notebook service), the FSU facilitators in each group used POGIL to facilitate the 3-hour hands on sessions.

Each session group had 8-10 participants with a mix of K-12 educators, community college, and university faculty members with one facilitator from FSU and a graduate assistant to assist as needed. Each group had a participant facilitator with a backup, a recorder with a backup, and an evaluator with a backup. Their roles were either reversed or other participants took on the positions, as desired.

The main intent behind using this technique was to enable workshop participants to learn and work in teams, collaborate to understand a concept and solve a structured problem or set of questions rather than being given the content via a lecture by a teacher.

The POGIL approach includes:
1) Faculty provided-model and related content and
2) Specific problem or defined set of questions for small groups to solve/answer with little guidance from the facilitator. While there are any number of student-centered classroom techniques, POGIL is unique in that it makes students responsible for their own learning, in collaborative teams, so it helps them develop group process skills while they are gaining content knowledge. Figure 1 below shows the Google Colab interface for Regression.

Figure 1: Google Colab Interface for Regression
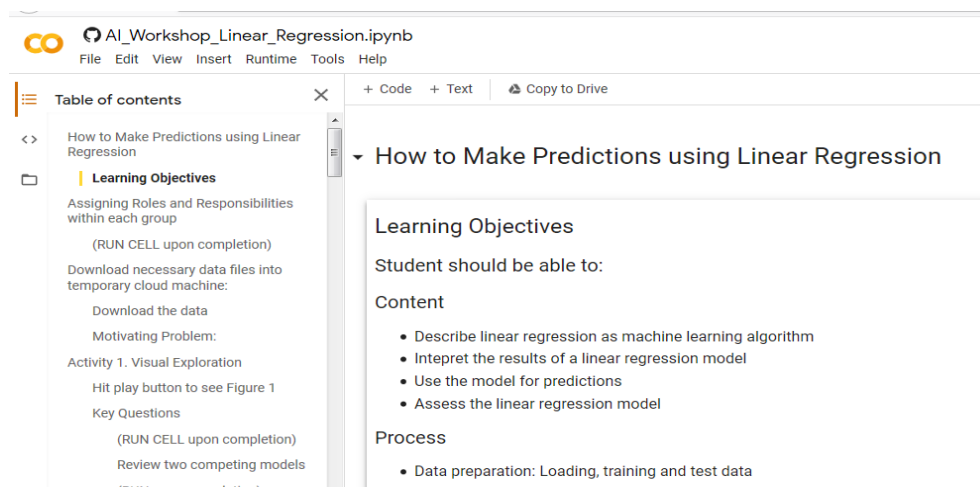
5. Review the 4 possible scenarios given below, all of the have the same $R^2 = 0.67$ and discuss why R^2 should be used with caution
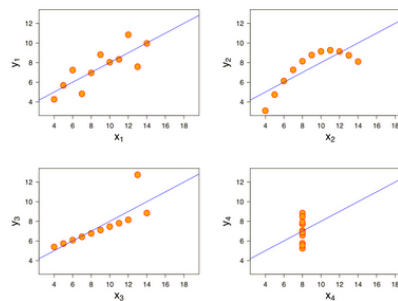
and never as sole criterion for determining the best model. Source: Wikipedia

6. Run the code below to see R^2 for the best model derived in **Activity 3**. Discuss with you group if R^2 alone can be a good measure of the model fit. Keep in mind the scenarios in the previous question.

[ ]   R-square for the model
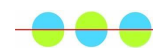
Evaluation

The AI workshop was externally evaluated by MN Associates, Inc. (MNA), a small, woman-owned K-16 research and evaluation firm based in Northern Virginia. MNA led by Dr. Kavita Mittapalli, participated in bi-weekly workshop planning activities from the start as well as attended the workshop in July.

Methodology

The PI, Co-PIs, and MNA co-developed an online participation interest form (pre-survey) that was sent to various UNC system colleges, universities, and high schools to help recruit workshop participants. Questions related to demographic questions as well as prior/current knowledge of AI topics such as Artificial Intelligence, Regression, Decision Tree, and Artificial Neural Networks were posed. Upon completion, the PI extended a formal e-invite to the participants in preparation of the workshop.

A post-survey with the same questions in knowledge gained as a result of attending the workshop in Artificial Intelligence, Regression, Decision Tree, and Artificial Neural Networks were posed in addition to a series of multiple-choice and open-comments questions related to each day's sessions such as: Day 1 keynote speeches, introduction to Google Colab; hands-on sessions on Days 2-4 on Regression, Decision Tree, and Artificial Neural Networks, and Day 5 including keynote speech, student-led panel discussion with academic and industry-level professionals, and participants' presentations were asked.
See a copy of the post-survey in Appendix. The participant form and survey were IRB-approved prior to administration.

The following sections of the report present data from the participant interest form as well as post survey. All data are aggregated. Anecdotes are presented for emphasis throughout the report.

Participants

A total of 30 participants engaged in all sessions offered at the AI workshop. They were offered $500 stipend upon completing all the activities. The pool was represented by university, K-12 institutions, community colleges, and industry or government. More than half of the participants were from university (57%) followed by K-12 (37%). One of the K-12 participants was a high school junior. Note that five individuals attended a few sessions of the workshop but did not participate in the 3-day virtual sessions. They were not given the post survey.

Figure 2: Number of Workshop Participants by Institution Type

More than half of the participants were from university

Institution	Count
University	17
K-12	11
Community College	1
Industry/Government	1

(N = 30)
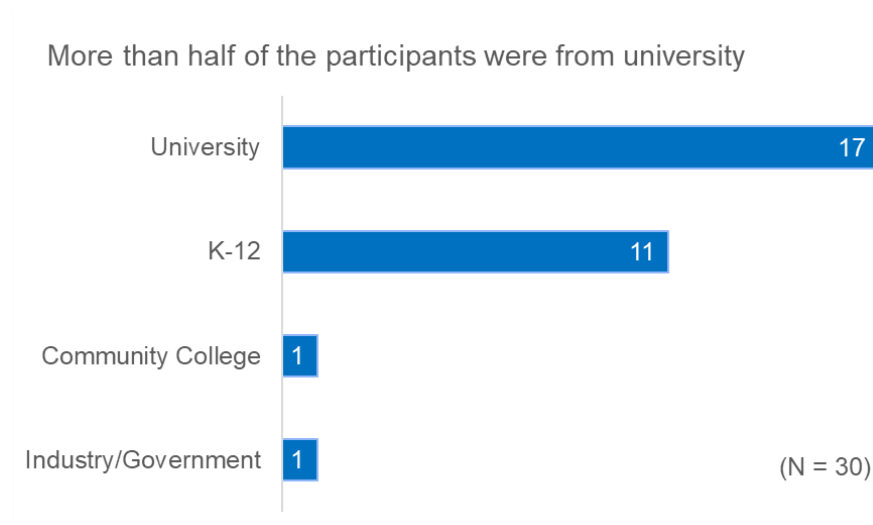
Below is the list of affiliation of the participants.

Table 2- Affiliation of AI Workshop Participants

Participant Affiliation	N
Fayetteville State University	6
Elizabeth City State University	5
North Carolina A&T State University	3
Cumberland County Schools	1
Douglas Bryd High School	1
East Chapel Hill High School - Chapel Hill Carrboro City Schools	1
Forsyth Technical Community College	1
Hoke County High School	1
Hoke County Schools	1
Johnson C. Smith University	1
Junior at TJ High School/VA	1
Lakewood Montessori Middle School	1
Northeast Guilford High School	1
Pine Forest High School	1
Seventy-First High School	1
Seventy-First High School, Cumberland County Schools	1

Participant Affiliation	N
UNC Chapel Hill	1
UNC Charlotte	1
Winston-Salem State University	1

Survey Responses

In the pre- and post-workshop surveys, the participants were asked to rate on a 5-point Likert scale (Low to Very High) the level of their understanding of four topics- Artificial Intelligence, Regression, Decision Tree, and Artificial Neural Network before and after the workshop. The results are summarized below.

Artificial Intelligence

Survey results show that 47% of the participants reported the workshop improved their understanding of AI and 53% reported their understanding of AI remained at the same level after the workshop. The non-parametric significance test conducted on the paired responses indicates that the median difference between pre- and post-workshop ratings is statistically significant with a p-value < 0.001.

Figure 3: Pre- and Post-Workshop Ratings on the Understanding of AI

Median rating on understanding of AI increased from 3 to 4 (N = 30)
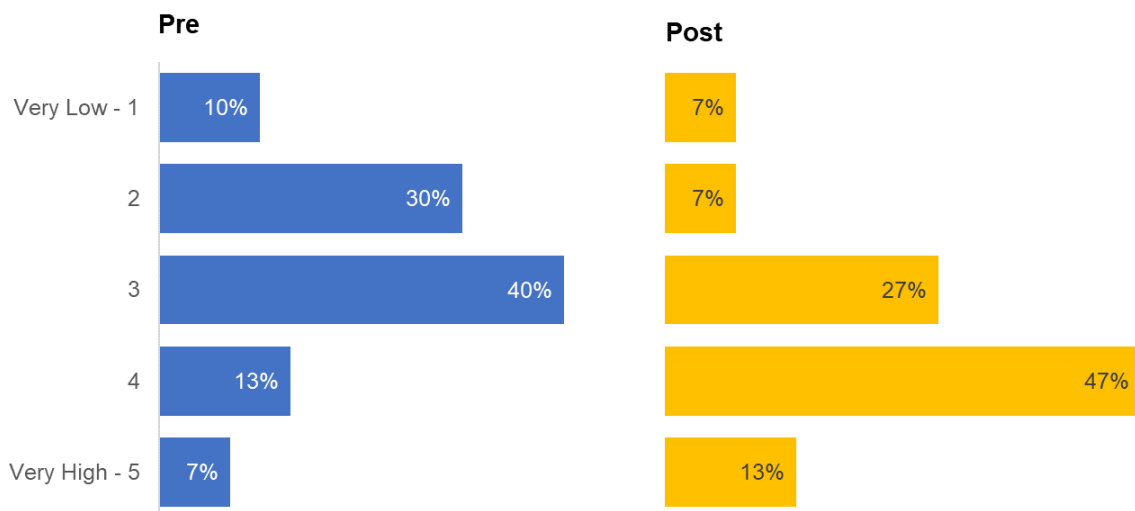
Regression

Survey results show that 50% of the participants reported that the workshop improved their understanding of regression, 37% reported their understanding of regression remained at the same level, and 13% reported their understanding of regression declined after the workshop. However, the median rating on the topic increased from 3 (pre-workshop) to 4 (post-workshop). The non-parametric significance test conducted on the paired responses indicates that the median difference between pre- and post-workshop ratings is statistically significant with a p-value < 0.001.

Figure 4: Pre- and Post-Workshop Ratings on the Understanding of Regression

Median rating on understanding of regression increased from 3 to 4 (N = 30)
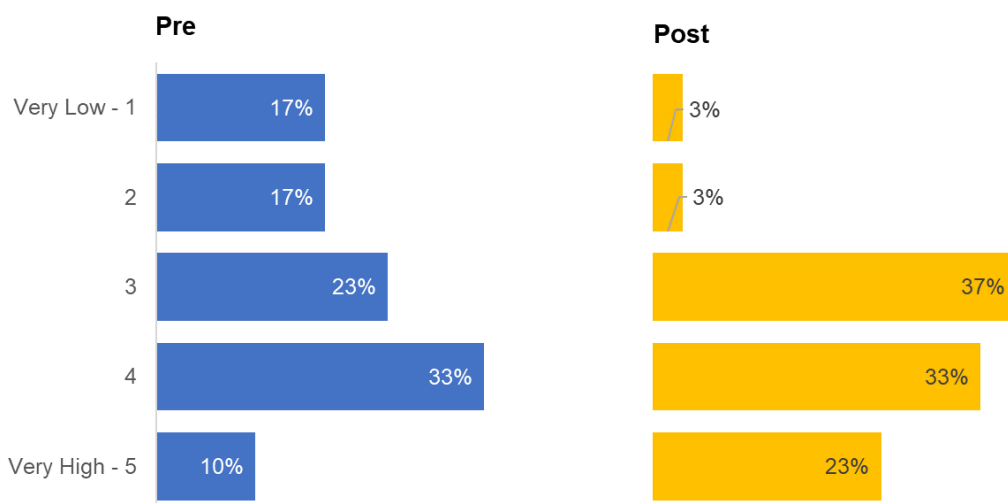
Decision Tree

Survey results show that 70% of the participants reported the workshop improved their understanding of decision tree, 23% reported their understanding of decision tree remained at the same level, and 7% reported their understanding of decision tree declined after the workshop. Median rating on this topic increased from 3 (pre-workshop) to 4 (post-workshop). The non-parametric sign test conducted on the paired responses indicates that the median difference between pre- and post-workshop ratings is statistically significant with a p-value < 0.001.

Figure 5: Pre- and Post-Workshop Ratings on the Understanding of Decision Tree

Median rating on understanding of decision tree increased from 3 to 4 (N = 30)
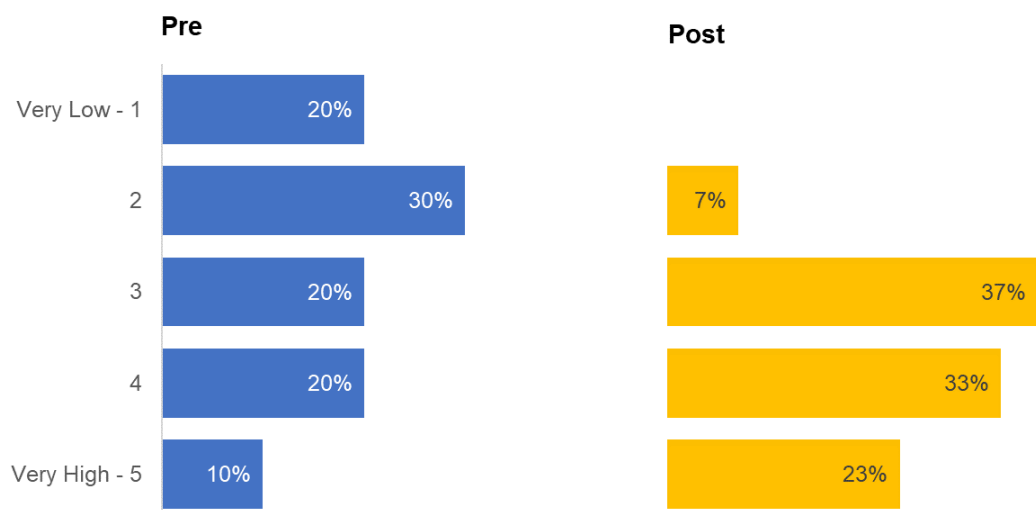
Artificial Neural Network (ANN)

Survey results show that 70% of the participants reported the workshop improved their understanding of ANN, 23% reported their understanding of ANN remained at the same level, and 7% reported their understanding of ANN declined after the workshop. Median rating on this topic increased from 2 (pre-workshop) to 4 (post-workshop). The non-parametric significance test conducted on the paired responses indicates that the median difference between pre- and post-workshop ratings is statistically significant with a p-value < 0.001.

Figure 6: Pre- and Post-Workshop Ratings on the Understanding of ANN

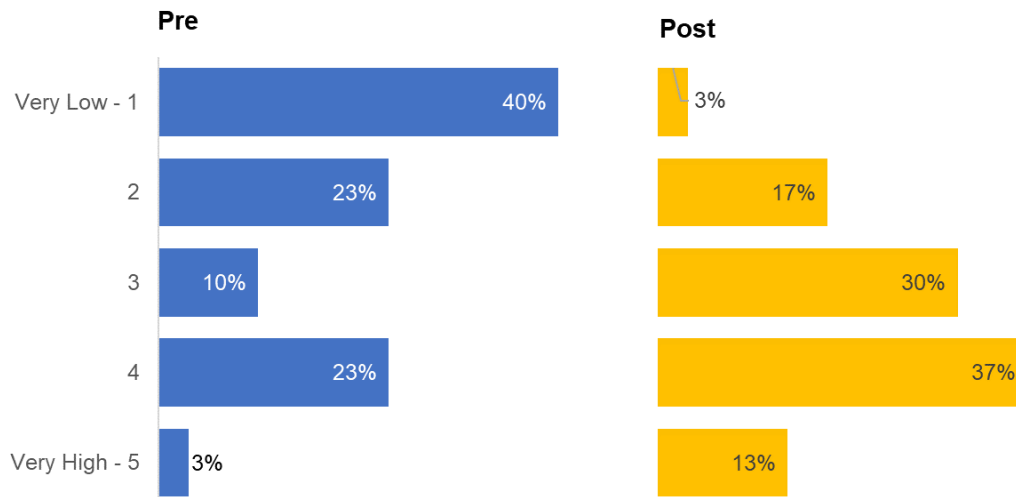Median rating on understanding of ANN increased from 2 to 4 (N = 30)

	Pre	Post
Very Low - 1	40%	3%
2	23%	17%
3	10%	30%
4	23%	37%
Very High - 5	3%	13%

Other-Workshop Survey Responses

In this section, responses of the participants on various items related to the workshop are summarized. The participants rated their experiences on a 3-point Likert scale - "completely adequate/very satisfied", "somewhat adequate/satisfied", "not at all adequate/satisfied."

Day 1 - Welcome, Keynote Address, and Introduction to Google Colab

The post-workshop survey indicates that the majority of the participants (more than 85%) were highly satisfied with the welcome session, workshop logistics, and keynote speakers—Emily Hand, Ph.D. and Kathleen Featheringham, M.S.

EMILY HAND, PH.D

Dr. Emily Hand is an Assistant Professor in the Department of Computer Science and Engineering at the University of Nevada, Reno. She has B.S. degrees in Computer Science and Engineering as well as Applied Mathematics, and an M.S. and Ph.D. in Computer Science. Dr. Hand is the director of the Machine Perception Lab at UNR. Her primary research interest lies at the intersection of machine learning and human perception. The long-term goal is to build a discrete wearable device for people with disabilities to improve social interactions using visual and language cues. Dr. Hand is the faculty advisor for Women into Computer Science and Engineering at UNR and she volunteers with Girls Who Code, teaching girls the basics of programming

KATHLEEN FEATHERINGHAM, M.S.

Kathleen is a director at Booz Allen Hamilton, specializing in analytics and strategy. She is a leader of highly technical cross-functional teams supporting clients with their transformation and adoption to a data-driven organization leveraging artificial intelligence and data science. She is the functional lead of Booz Allen's industry leading Analytics University which includes the award-winning Data Science Foundational Program. Kathleen holds a M.S. in Intelligence Analysis from Mercyhurst College and a B.S. in Business Administration from Georgetown University. She is a certified Advanced Change Management Practitioner, Georgetown University.

Figure 7: Day 1 (All Sessions) - Percentage of Participants Reported

"Completely Adequate/Very Satisfied"

Participants expressed high level of statisfaction with the logistics and speakers on the opening day (N = 30)

Session	%
Workshop overview, welcome comments, check in via zoom	93%
Reminders and logistics	90%
Keynote address by Kathleen Featheringham, Booz Allen	87%
Keynote address by Emily Hand, University of Nevada	87%
Reading articles and book chapters (self-paced)	80%
Demonstration of AI-POGIL by students	77%
Getting started with Google Collaboratory and AI programming	67%

Participant comments:

"The google Colab was hard to follow and needed more time on it, learned more once hands on."

"Adequately paced all day workshop with genuine breaks and very informative keynote address."

"May give some time for student interactions, introductions."

Day 2 - Regression

On Day 2, participants worked on activities related to estimating and interpreting linear regression models. The post-workshop survey asked participants about their experiences with various aspects of this session. The figure below shows the percentage of participants who found various aspects of the session were completely adequate.

On average, the participants from universities expressed higher levels of satisfaction with the session than their peers from the K-12 schools and community colleges. Except for the performance of the facilitators, every other item sees a large difference between the two groups. Relevance of the topic to one's teaching and prior familiarity with both content and technology like Google Colab appeared to have contributed to varied experiences in the groups.

Figure 8: Day 2 (Regression) - Percentage of Participants Reported

"Completely Adequate/Very Satisfied"

On average participants from **university** expressed higher level of satisfaction with the Regression session than their counterparts from **K-12 institutions and community college** (N = 30)
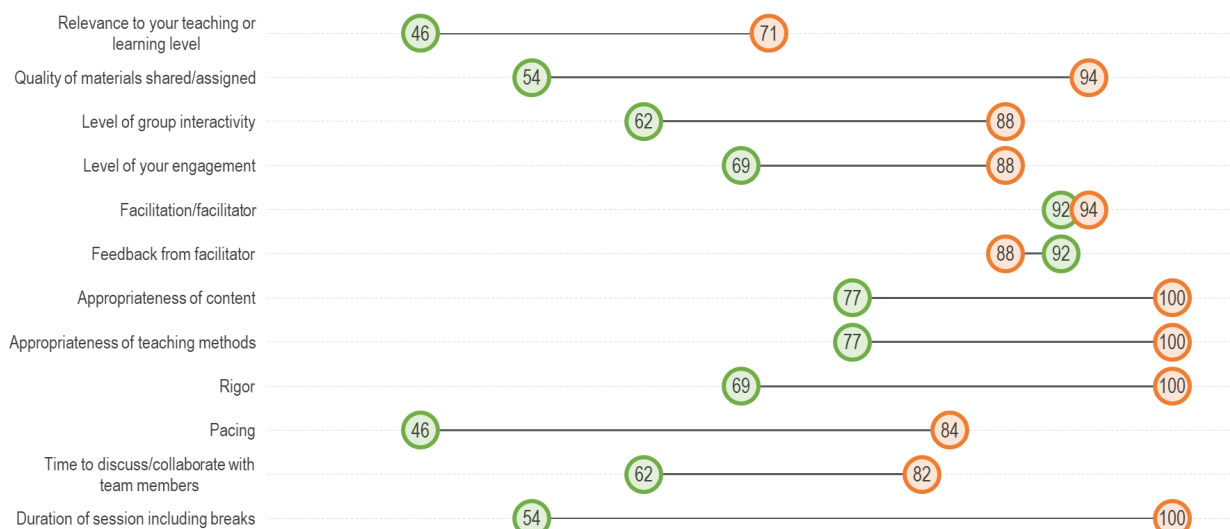
K-12 participant comments:

"It would help to have a preview into the content so we could have paced better and completed more activities."

"Very interesting topics that were helpful with my planned presentation to my students."

"Colab was a bit confusing to grasp so maybe next time have a day for people to learn about Colab."

University participant comments:

"Students can have the option to work on their own data sets and work individually first. After everyone finishes, then they can discuss."

"Exceptionally brilliant session!!".

"Given the varied degree of participants' prior knowledge and background, the experience was varied. The sudden introduction of ML without any background was difficult to comprehend."

Day 3 - Decision Tree

On Day 3, participants worked on activities related to running decision tree ML models. The figure below shows the percentage of participants who found various aspects of the session were completely adequate. Consistent with the regression session, on average, the participants from universities expressed higher levels of satisfaction with the decision tree session than their peers from the K-12 schools and community colleges. Except for the performance of the facilitators, large differences in the level of satisfaction are observed between the two groups.

Figure 9: Day 3 (Decision Tree) - Percentage of Participants Reported

"Completely Adequate/Very Satisfied"

On average participants from **university** expressed higher level of satisfaction with the Decision Tree session than their counterparts from **K-12 institutions and community college** (N = 30)
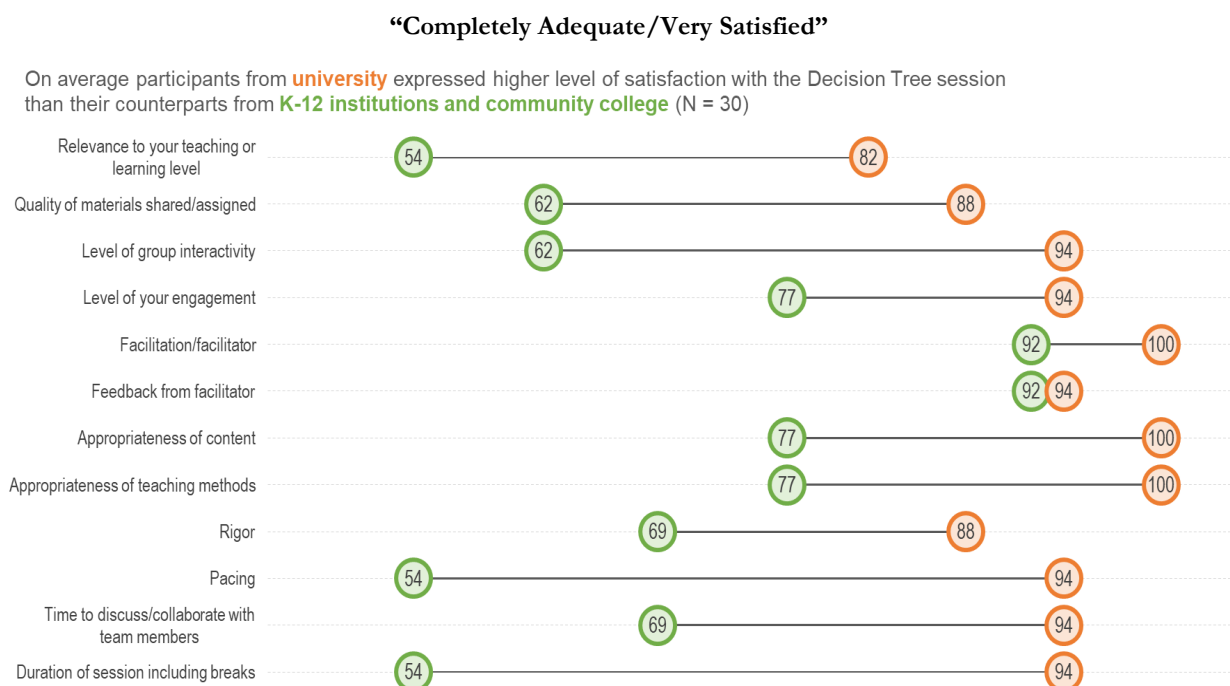
K-12 participant comments:

"It was more challenging and needed additional information and clarity".

"It took 40 minutes for the recorder and facilitator to get the group going because the facilitator kept asking questions on how to complete Colab. I understand that we all need to learn but this took the group off task, slowed down progress and we did not have time in the afternoon to complete our individual presentations like planned."

"My favorite topic from the workshop."

University participant comments:

"It was much better than regression."

"It is a good method to divide and analyze the problem and create categories."

"You may want to add more explanations for figures. Some of them are hard to interpret."

Day 4 - Artificial Neural Network

On Day 4, participants worked on activities related to artificial neural network models. Again, the figure shows response patterns very similar to the previous two sessions. Overall, the reflections on the session noted by the participants were positive.

Figure 10: Day 4 (ANN) - Percentage of Participants Reported

"Completely Adequate/Very Satisfied"

On average participants from **university** expressed higher level of satisfaction with the ANN session than their counterparts from **K-12 institutions and community college** (N = 30)

	K-12	University
Relevance to your teaching or learning level	62	77
Quality of materials shared/assigned	77	94
Level of group interactivity	62	88
Level of your engagement	77	88
Facilitation/facilitator	92	100
Feedback from facilitator	92	94
Appropriateness of content	77	94
Appropriateness of teaching methods	69	88
Rigor	77	94
Pacing	69	94
Time to discuss/collaborate with team members	62	94
Duration of session including breaks	62	94

K-12 participant comments:

"Based on our experience with the previous 2 days, we were able to get better pace and cover more activities in this session."

"The input of the group was not happening, out of 10 people only 4 or 5 were actively participating."

"Some of the information was totally foreign to me but the methods used to help us through the teaching of this were excellent. Very relevant."

University participant comments:

"For the first time I have learned what ANN really is. It was good to see it in action and learn at the same time."

"A little difficult for the beginners. Some easy techniques could have been utilized for orienting the beginners."

"This was the most valuable activity for me to understand the concept of neural networks, especially how the weights really work. Of course, the session was an excellent opportunity to learn and network."

Day 5 - Keynote Address and Participant Presentations

Day 5 began with the final keynote address by Dr. Sudipta Dasmohapatra, faculty at Duke university, followed by a presentation by individual participants. The post-workshop survey asked participants to rate various sessions.

Overall, the participants appeared to be highly satisfied with the sessions. Participants were given the flexibility to present either their own codes or discuss a topic of their choosing that they learned from the workshop. Only 3 out of 30 participants chose to present a code.

SUDIPTA
DASMOHAPATRA, PH.D

Sudipta Dasmohapatra is a faculty and the Director of the Masters in Statistical Science Program at Duke University. She is also an adjunct professor at the Fuqua School of Business where she teaches advanced data science and analytics courses. She is currently serving as the Associate Director of Diversity for SAMSI and is working on several initiatives to identify opportunities for under-represented groups to participate in SAMSI's mission and programs. Sudipta has worked as a data science advisor for numerous industry collaborators including financial, technology, environmental, healthcare, service, and retail firms. Before joining Duke in 2017, Sudipta was as an associate professor at the Institute for Advanced Analytics at North Carolina State University
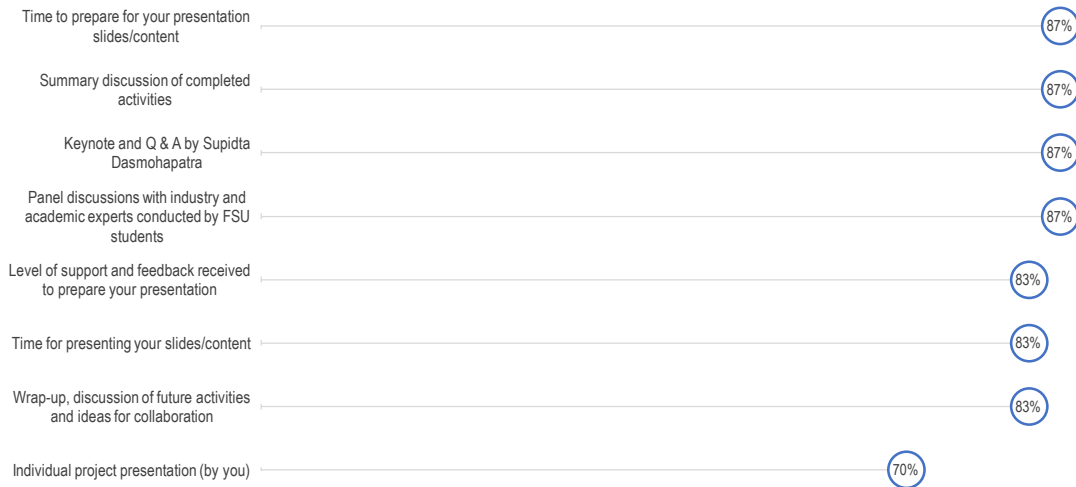
Figure 11: Day 5 (Closing Sessions) - Percentage of Participants Reported

"Completely Adequate/Very Satisfied"

Participants expressed high level of statisfaction with the sessions on the closing day (N = 30)

Item	Percentage
Time to prepare for your presentation slides/content	87%
Summary discussion of completed activities	87%
Keynote and Q & A by Supidta Dasmohapatra	87%
Panel discussions with industry and academic experts conducted by FSU students	87%
Level of support and feedback received to prepare your presentation	83%
Time for presenting your slides/content	83%
Wrap-up, discussion of future activities and ideas for collaboration	83%
Individual project presentation (by you)	70%

Participant comments:

"Excellent keynote and great to hear presentations from all participants."

"Having so many panels and keynote speakers back to back became a bit cumbersome."

"Increase time per session and a smaller number of sessions."

Open-Ended Comments

A set of open-ended questions were posed at the end of the post-survey that focused on items related to the extent to which the participants learned from their experience as a recorder, facilitator, or an evaluator during the Days 2-4 interactive sessions and how the sessions could be improved in future followed by how they participants intended to implement some of the POGIL teaching strategies and/or software tools (e.g, Jupyter notebooks/Colab) in their classroom setting.

First, to the question on their role as a recorded, facilitator, or an evaluator, 20 responses were collected. Those who were in the role of a facilitator or a back-up, their responses were mostly positive

Facilitator - my experience was excellent - even though I had many interruptions due to other staff within my building needing my attention - my backup - Reema - was ready to step right in - I felt Denny was an excellent leader and kept us moving forward.

I was a back-up facilitator and recorder. I experienced better understanding in these roles as compared to being just a participant. As a facilitator, you have to comprehend the information as you ask questions; thus, you put more conscious effort and ask questions if needed that otherwise you may be shy about. As a recorder, again, you have to comprehend the responses before you record them. I believe there are no changes needed for these positions.

A few recommendations for change were made

Very good experience and only if there are more time and prior knowledge.

I was a facilitator and enjoyed leading the group. I could improve by knowing more about the topics before facilitation.

Please allow everyone to see the information clearly before documenting it.

Those who were either a recorder or an evaluator had similar positive experiences and made some suggestions for change:

I was an evaluator-my experience was fine. I saw no need to change anything.

I was a recorder and an evaluator. I think recorder and the facilitator should be the same person or better yet, each participant should be a facilitator and recorder on separate datasets. Then record their own session.

I felt responsible and it kept me more alert and active during the session. It may have helped to go over it prior to the actual session.

Colab was not the best software to use in my opinion (as a computer science student we don't really use colab but we use JGrasp, Octave, MetLab, or StudioCodeX)

To the question, which aspects of the workshop are you likely going to use in your teaching and how, several responses were gathered around teaching POGIL and AI concepts and misconceptions to students, teaching other educators on campus, using Colab and Jupyter notebook, decision tree and plotting features. Some pertinent responses are

I will use POGIL. The use of role assignment - and I am currently looking at how some of my curriculum has changed and how I can use electronic notebooks or something similar to help my student groups stay on target/track.

I will use Colab and the use of a facilitator, recorder, and evaluator in some of my classrooms.

I will propose and teach a Data Science course. I may modify and use Colab notebooks there.

I will inform my technology students of the existence of such an area and how they can prepare themselves now.

Depending on the curriculum that I am given for my Cybersecurity and Networking classes that I will be teaching I will be using a great deal of it. I will at least reference the book and Artificial Intelligence as a whole, it is all tied in together.

For the online data science certificate program at UNC I have already proposed the use of Google Colab tools and POGIL methods for content development.

To the next question, based on your learning from the workshop during these past days, is it likely that you will apply any of the topics and/or concepts when you return to your classroom? If yes, what are those and how do you plan to use them? If not, why not, responses were quite similar to the above question. They are

Maybe, ANN can be implemented.

Yes, as required. In particular the book and Colab. I work with startup founders, so not a typical classroom environment.

I would like to use it for our AB days for online teaching.

I want to ensure that my students know that certification in Microsoft is the first step in learning about virtual machines.

Depending on the curriculum that I am given for my Cybersecurity and Networking classes that I will be teaching I will be using a great deal of it. I will at least reference the book and Artificial Intelligence as a whole, it is all tied in together.

Yes, I can use regression and decision tree in my classes. Then, we can compare engineering vs. business students' performance.

I plan to use similar notebooks for LR, DT, and ANN later in a new course that I will teach. I have not yet finalized the course outline.

In relation to the extent to which the participants are likely to apply the POGIL technique in their teaching when they return to their classroom, a majority of the responses were No, Unsure (at this point), It depends, and Maybe. Some stated reasons were: (I would like to) gauge the feasibility and applicability of POGIL in the classroom setting on the lessons/modules I am teaching before using it; and not fully understanding what POGIL is or does in a classroom setting.

Other comments where participants expressed an interest to use POGIL method were

I do not work with a typical classroom, but I would explore the opportunities to use this technique.

It will be a great way to get away from the traditional video lecture and assessments for learning.

I will guide my students through the processes of how artificial intelligence can be used in research.

As long as I am allowed to, I will at least introduce it to my students at least as a knowledge base for them.

Definitely! It's always exciting to have a new tool in the tool box.

I haven't tried it before. It's a student-centric approach and I'll consider using it.

A majority of the participants (60%) stated that they are excited/ enthusiastic to a large extent about applying what they learned in the workshop (content and pedagogy) in their teaching/instruction.
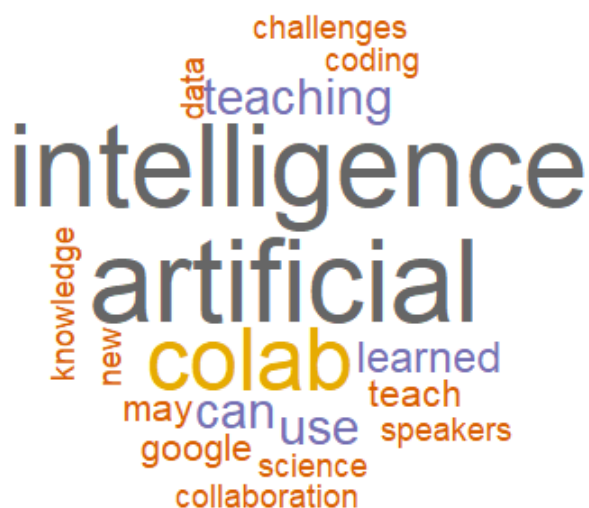
General Takeaways

The workshop was organized and conducted well. About 75% of the participants reported that to a large extent, they see the benefits of using cloud computing in their academic settings. About the same percentage of participants also reported that to a large extent, they understood the differences between learning algorithms and software and they would be able to explain to their students the concepts of AI learned from the workshop. About 56% of the respondents reported that their awareness of how AI can be misused to spread fake news and information has increased to a large extent.

The word cloud below summarizes the participants' responses about main takeaways from the workshop. Artificial Intelligence, and Google Colab are the topics most frequently mentioned by the participants. The majority of the participants also noted that they are open to apply technologies like Google Colab and POGIL, to teach AI in their institutes.

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Figure 12: Word Cloud of Three Main Takeaways from the Overall Workshop

Areas of Enhancement

Based on MNA's observations, post-survey responses from participants, and feedback provided during the individual presentations on Day 5, the following areas of enhancement are suggested:

- Design of future workshops could be adapted to participants' skill level and relevance.
  For example, participants from K-12 and higher education have very different needs and technical exposure to advanced topics such as those presented in the workshop. The workshop contents could be better designed and organized to meet these needs.

- Several participants mentioned that basic preparatory materials including presentation slides could be shared with the participants prior to the workshop to allow time for review.

- Create shared Google folders to help track individual participant's performance on Days 2-4.

- Specific to the usage of a virtual mode to conduct a workshop, one comment was
  Definitely use Zoom but create detailed learning objectives, have materials developed early on and tested. Review participant's prior knowledge, background, and teaching experience. Consider engaging an instructional designer to help with smooth operations of technology, workshop presentations, etc.

- Assign reading directly related to the hands-on activities to enable easier understanding of concepts.

- Technical challenges with software, internet connection, and device(s) are inevitable to occur with online delivery, however, provide clear and prior guidance prior to the workshop.

- Day 5 could be shortened by reducing the number of individual sessions and include an option of small group presentations.
- Develop a website or webpage on FSU site to host all the workshop materials for easy access to all participants. Use a dissemination mechanism to share these resources with participants and other collaborators.

Appendix

Participation flyer

Agenda

Time	Activities
08:45 AM – 09:30 AM	Online check in via Zoom, welcoming comments, workshop overview
09:30 AM – 09:45 AM	Break (10-15 mins)
09:45 AM – 10:45 AM	Keynote and Q&A by Kathleen Featheringham, Booz Allen Inc.
10:45 AM – 11:00 AM	Break (10-15 mins)
11:00 AM – 12:00 PM	Keynote and Q&A by Emily Hand, University of Nevada
12:00 PM – 01:00 PM	Lunch break (1 hour)
01:00 PM – 01:30 PM	Getting started with Google Collaboratory and AI programming
01:30 PM – 01:45 PM	Break (10-15 mins)
01:45 PM – 02:15 PM	Demonstration of AI-POGIL by students
02:15 PM – 02:30 PM	Break (10-15 mins)
02:30 PM – 02:45 PM	Reminders and logistics
Flexible, start at your convenience	Read articles and book chapters which will be given to participants. This is a self-paced activity which may take 2 – 3 hours of time.

DAY TWO - TUESDAY JULY 21ST

Time	Activities
09:45 AM – 10:00 AM	Online check in via Zoom assigned to group, preliminary discussions
10:00 AM – 01:00 PM	Three hours of hands-on training on AI topic: Regression & Teaching Methods. Flexible break times to be decided by group and facilitator. Group 1 (Facilitator: Sambit Bhattacharya) Group 2 (Facilitator: Denny Czejdo) Group 3 (Facilitator: Valentin Milanov)

DAY THREE - WEDNESDAY JULY 22ND

Time	Activities
09:45 AM – 10:00 AM	Online check in via Zoom assigned to group, preliminary discussions
10:00 AM – 01:00 PM	Three hours of hands-on training on AI topic: Decision Tree Learning & Teaching Methods. Flexible break times to be decided by group and facilitator. Group 1 (Facilitator: Sambit Bhattacharya) Group 2 (Facilitator: Denny Czejdo) Group 3 (Facilitator: Valentin Milanov)

DAY FOUR - THURSDAY JULY 23RD

Starting Time	Activities
09:45 AM – 10:00 AM	Online check in via Zoom assigned to group, preliminary discussions
10:00 AM – 01:00 PM	Three hours of hands-on training on an AI topic: Neural Networks & Teaching Methods. Flexible break times to be decided by group and facilitator. Group 1 (Facilitator: Sambit Bhattacharya) Group 2 (Facilitator: Denny Czejdo) Group 3 (Facilitator: Valentin Milanov)

DAY FIVE - FRIDAY JULY 24TH

Starting Time	Activities
09:45 AM – 10:15 AM	Online check in via Zoom, summary discussion of completed activities
10:15 AM – 11:15 AM	Keynote and Q&A by Sudipta Dasmohapatra, Duke University
11:15 AM – 11:30 AM	Break (10-15 mins)
11:30 AM – 12:30 PM	Panel discussions moderated by students
12:30 PM – 01:30 PM	Lunch break (1 hour)
01:30 PM – 02:30 PM	Town hall discussions (open to all)
02:30 PM – 02:45 PM	Break (10-15 mins)
02:45 PM – 03:45 PM	Project presentations by groups
03:45 PM – 04:15 PM	Wrap-up, discussion of future activities and ideas for collaboration
04:15 PM – 04:30 PM	Completion of post-survey

FAYETTEVILLE STATE UNIVERSITY
STRATEGIES TO TRAIN AND ENGAGE STUDENTS IN ARTIFICIAL INTELLIGENCE
JULY 20-24, 2020 (via Zoom)
Pre-Survey

Dear educator/faculty member,
Congratulations for being selected as a participant in the virtual AI workshop being conducted by Fayetteville State University between July 20-24, 2020. The workshop is being externally evaluated by MN Associates, Inc. (MNA). Please take a moment to complete this survey by July 20th. Your individual responses will be kept confidential. You will not be assessed based on your responses. We are asking your name only for data collection purposes. Data will be reported in an aggregate in an evaluation report. For any question regarding the survey, please contact Kavita Mittapalli at kavita@mnassociatesinc.com. Thank you for your time and interest.

1. Your name:
2. Name of your institution? (e.g., School. School District, Community College. University)
3. Please rate your levels of knowledge and understanding of the following:

Item	1 (Very Low)	2	3	4	5 (Very High)
Artificial Intelligence					
Regression					
Artificial Neural Network					
Decision Tree					

4. Have you attended a similar (any) AI in Education workshop?
   YES
   NO
   If yes, please mention _____

5. Please tell us briefly what you expect to learn from the AI workshop?

6. Are there any (anticipated) challenges attending the workshop virtually?

7. Are there any (anticipated) challenges in adopting AI in educational materials used in your school/college/university? If yes, please mention.

8. Any additional questions or suggestions?

Thank you for your time and feedback!

Dear educator/faculty member,
Hope you have enjoyed the AI workshop. The workshop is being externally evaluated by MN Associates, Inc. (MNA). Please take a moment to complete this survey by **August 3rd.** We would like to know the extent to which the workshop has achieved its goals and objectives and your level of knowledge and satisfaction with the various sessions and activities you were exposed to during the workshop. Your individual responses will be kept confidential. We are asking your name only for data collection purposes. Data will be reported in an aggregate in an evaluation report. For any question regarding the survey, please contact Kavita Mittapalli at kavita@mnassociatesinc.com. Thank you for your time and interest.

1. Your name:
2. Your group no: (drop down) 1, 2, 3
3. Name of your facilitator (drop down) Sambit, Denny, Valentin
4. Please rate your current levels of **knowledge** and **understanding** of the following:

Item	1 (Very Low)	2	3	4	5 (Very High)
Artificial Intelligence					
Regression					
Artificial Neural Network					
Decision Tree					

5. Please rate the following on the basis of the extent to which you found them **useful/were satisfied** with each of the sessions/ activity per day. (Please check one response per row).

DAY 1 Activity	Not useful/Not at all satisfied	Somewhat useful/Somewhat satisfied	Very useful/Somewhat satisfied	Did not attend	Not Sure
Introduction to the AI Workshop					
Keynote speaker 1					
Q&As for keynote speaker 1					
Keynote speaker 2					
Q&As for keynote speaker 2					
Introduction to Days 2-4 session activities					
Reading activities/homework/mater					

ials shared at the end of Day 1					

6. If you checked **Not useful or Somewhat useful**, please mention why:

   How could Day 1 activities be further improved?

7. Please rate the following aspects of the sessions in general held on days 2-4.

Item/Activity	Strongly Disagree/Dissatisfied	Disagree/ Dissatisfied	Neutral	Agree/ Somewhat Satisfied	Strongly Agree/Very Satisfied
Regression = R, Decision Tree = T, Artificial Neural Network = N **Please put single letter (R/T/N) as shown above in appropriate box.**					
a. Relevance to your teaching					
b. Quality of materials					
c. Level of interactivity					
d. Level of your engagement					
e. Group dynamics					
f. Feedback from instructor/facilitator					
g. Content is appropriate for your students					
h. Quality and appropriateness of teaching methods presented					
i. Rigor is appropriate for your students					
COMMENTS					

   If you rated Strongly disagree or Disagree for any of the items above, please mention why.

8. How would you rate Day 5?

Item	Strongly Disagree/Dissatisfied	Disagree/ Dissatisfied	Neutral	Agree/ Somewhat Satisfied	Strongly Agree/Very Satisfied

Keynote speaker 3				
Panel discussion				
Town hall discussions				
Group presentations				
Wrap up by workshop organizers				

9. Please mark your response for the following items related to the content learned at the workshop:

Item	Not at all	To some extent	To a large extent	Can't say/Not sure
Do you see benefits of using cloud computing as access to hardware and software you don't need to manage and update themselves?				
Do you have a better understanding the difference between software that learns from data (AI software like face recognition) versus software that do not need training data to perform (e.g. spreadsheet)?				
How confident are you in your ability to explain to students the differences between AI versus non-AI software?				
Has your awareness of how AI can be misused to spread fake news & information (e.g. fake videos?) increased?				

13. What are the three main takeaways from the workshop?

14. Please describe which aspects of the workshop are you likely going to use in your teaching and how?

15. Based on your learning from the workshop during these past days, is it likely that you will apply any of the topics and/or concepts when you return to your classroom? If yes, what are those and how do you plan to use them?

If not, why not.

16. Based on your learning from the workshop these past days, is it likely that you will apply the POGIL technique in your teaching when you return to your classroom? Please explain. If not, why not.

17. To what extent are you excited/ enthusiastic about what you learned in the workshop (content and pedagogy) and how they apply to your teaching/instruction?
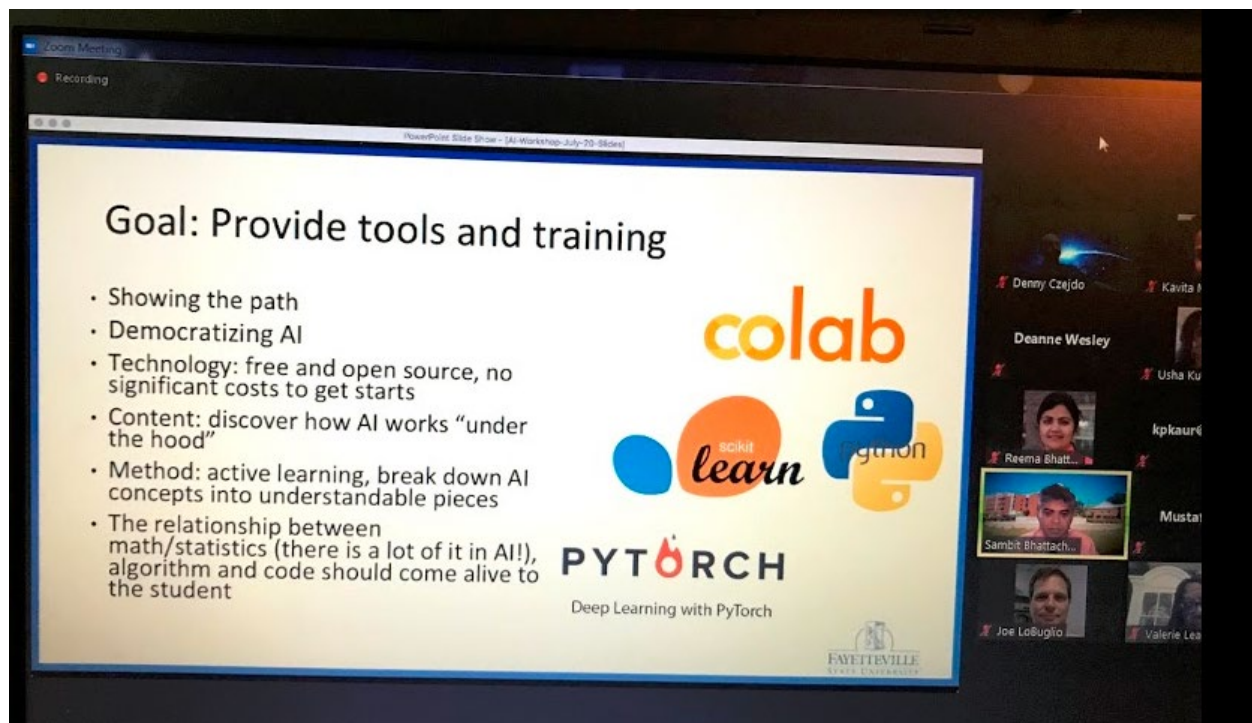
18. What are your suggestions to improve the materials, session format, or the workshop overall?

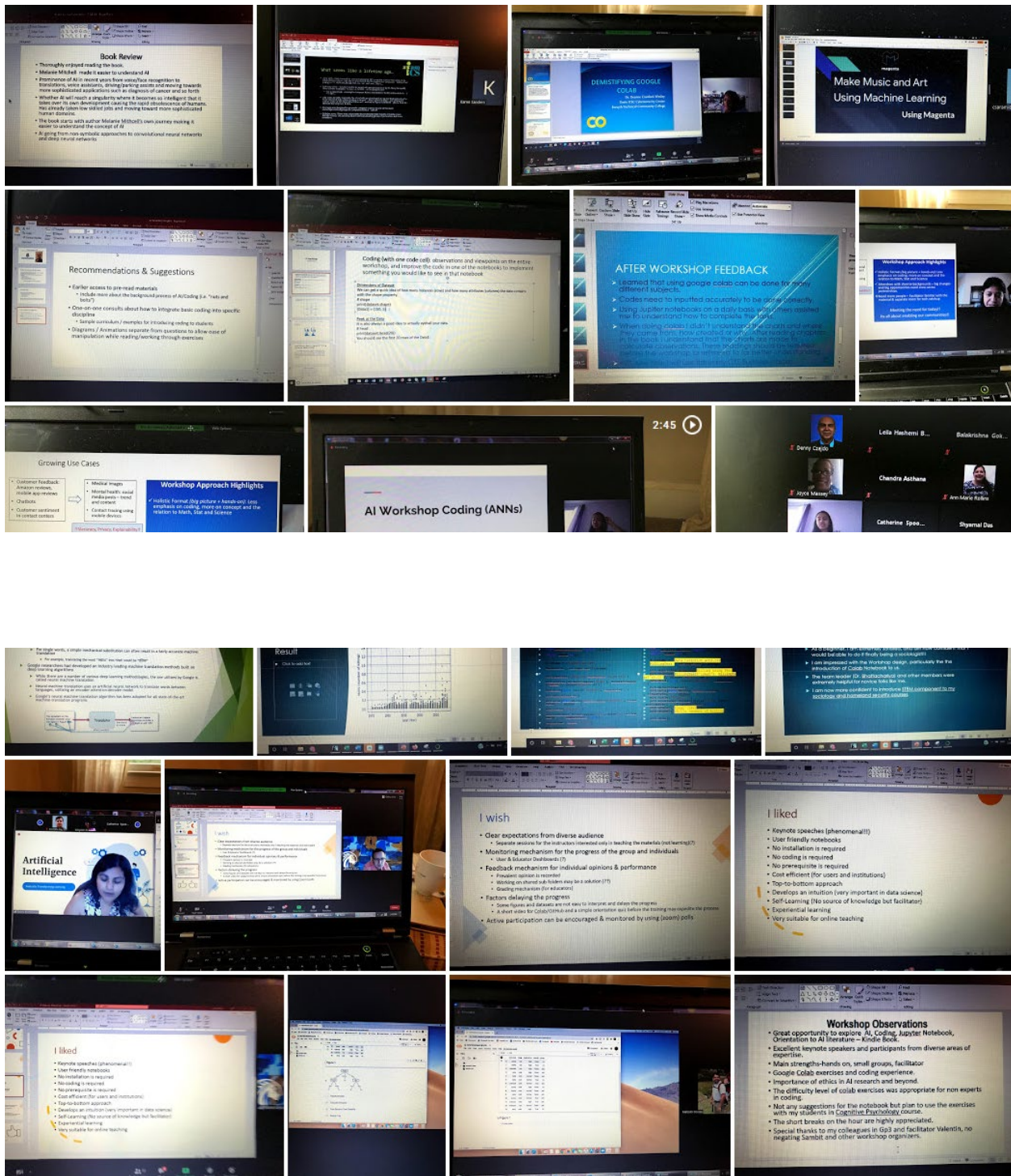19. Additional comments

Thank you for your time and feedback!