# *TECH2TEACHING CAPSTONE PORTFOLIO*

Center for Teaching and Learning

*Reddig, Jennifer M*

*Georgia Institute of Technology | Summer 2025*

## Table of Contents

# Mentor-Mentee Agreement

## Tech to Teaching Capstone
## Mentor-Mentee Agreement

### I. Purpose

Aligning expectations and communication avenues is critical in mentoring. This document serves to help bring forth information that will be critical to forming a solid working (and learning!) relationship between mentors and mentees in the Tech to Teaching program. We strongly suggest that this document and its contents be viewed as a *starting place* for conversations and that you establish ways to check in with each other regularly.

### II. Observation Dates

In the table below, capstone participants (mentees) who are *Instructors of Record* should identify the dates and topics for their intended observation dates. Mentees who are *Co-Teachers* should work with their mentor to identify appropriate dates and topics.

| | ***Observation 1*** | ***Observation 2*** *Note this should be at least 1 week after the first observation if at all possible |
|---|---|---|
| Date | 6/5/25 | 6/24/25 |
| Topic | Reasoning w/ uncertainty | Probabilistic reasoning over time |
| Mentor will attend? (not required) | ☑ | ☑ |
| Materials for use exist for adaptation/inspiration | ☐ | ☐ |

*Notes about Observation Date Planning:*

- Topics don't need to be finalized when scheduling, but should be discussed well in advance so the mentee can prepare
- Mentors are encouraged (but not required) to attend their mentee's observation and should inform them in advance if they plan to attend (to calm nerves)
- CTL and capstone observers will attend the full class if it's under 90 minutes; for longer classes, the mentee should select a 50–90-minute portion for observation
- Observations should take place between Weeks 5–15 (fall/spring) or Weeks 3–9 (summer); contact the capstone instructor if an earlier date is needed
- CTL will distribute a student feedback form at the end of the class; mentees should reserve 5 minutes for students to complete it
- Mentees should be responsible for classroom management on teaching days (e.g., roll, announcements, discipline, enforcing policies)
- As much as possible, the mentee should develop the lesson they will deliver, including learning goals, lesson plan, reading selection, slide development, classroom activities, demonstrations, and homework problems, etc.

## III. Additional Important Dates

*Additional Teaching Dates (if any):*

The Tech to Teaching capstone requires participants to deliver at least two class periods, but extra opportunities for content delivery are encouraged because they can support sustained teaching development. The table below provides space to document potential additional teaching dates, if applicable. Any additional sessions should come after the two sessions that count as observations for the Tech to Teaching capstone.

| Date(s) | Topic | Mentor Will Attend | Materials Exist |
|---|---|---|---|
| 7/17/25 | | ❑ | ❑ |
| | | ❑ | ❑ |
| | | ❑ | ❑ |

*Key Unavailable Dates (affecting feedback or meetings):*

Please list any key dates or time periods during the term when either the mentor or mentee will be unavailable in a way that could impact **feedback, meetings, or preparation of materials**. These might include planned travel, major deadlines (e.g., grants, conferences), or academic milestones (e.g., qualifying exams). You do **not** need to list general availability, just dates that may require adjustment to your normal communication or review schedule.

| Date(s) | Who is unavailable | What adjustments may be needed? |
|---|---|---|
| 6/24–7/16 | mentor | |
| | | |
| | | |
| | | |

## IV. Expectations for mentorship

The mentor and mentee will meet as needed to discuss the mentee's capstone activities. Meetings can be used to give the mentee assistance and/or feedback on instructional materials, to discuss upcoming class deliveries by the mentee, to evaluate class deliveries by the mentee, or discuss other issues related to teaching at Georgia Tech. The mentee may also request to discuss work-life balance/time management strategies, life as a faculty member, the academic job search, the mentor's teaching philosophy, the mentee's teaching philosophy, and other teaching-related topics and resources the faculty mentor may suggest.

*Note that some items may not be things you feel comfortable disclosing on this form, and some things may come up as your relationship develops; please remain open to those ideas!*

| **Tech to Teaching Capstone Mentee:** *Please describe your goals for the capstone experience. How can your faculty mentor help?* |
|---|
| Learn how to scale interactive & physical simulation teaching methods to a large class (>30 students)<br><br>Effectively use TAs to support |

| **Tech to Teaching Capstone Mentor:** *Reflect on the areas above. Are you comfortable guiding the mentee around these topics? Is there anything you for which would feel more comfortable referring the student out to others/other resources?* |
|---|
| |

## V. Mentorship Checklist

This checklist is designed to guide important conversations between mentors and mentees and to help meet the expectations of the Tech to Teaching program. You do not need to check every box, but you will be asked to sign off that you've discussed these topics. **Bolded items are most important at this stage.**

- ☑ **We've discussed and agreed on observation dates.** *Note: CTL needs at least two weeks' notice to adjust observation dates due to the need to coordinate many schedules.*
- ☑ **We'll follow through on commitments and will give each other (and CTL, if needed) advance notice when plans change.** *(See note above about date changes)*
- ☑ We've discussed what topics the mentee will cover, any materials the mentee will have access to, how much flexibility they'll have with existing content, and any additional contributions from the mentee (e.g., syllabus, assessments, Canvas, course content.)
- ☑ We've established expectations for feedback and communication, including how often we'll check in and what format we'll use (e.g., post-teaching debriefs, email, meetings).
- ☑ We've discussed how we'll handle any challenges that may arise, such as schedule conflicts, unclear roles, or unexpected changes, and how we'll try to prevent them.
- ☑ We'll engage in open, respectful communication. The mentor will offer honest feedback and acknowledge when a topic is outside their expertise. The mentee will respect any limits on time or topics.

**By signing below, the mentee and their mentor agree that they have reviewed the material and are in agreement regarding the expectations for this capstone teaching experience.**

Jennifer Reddig 5/20/25

Mentee's Name Signature Date

Bryan Wallace 5/20/25

Mentor's Name Signature Date

Materials adapted from Handelsman, J., C. Pfund, S. Miller Lauffer, and C. M. Pribbenow (2005). *Entering Mentoring: A Seminar to Train a New Generation of Scientists*. Madison, WI: University of Wisconsin Press

## Lesson Plan 1

# Lesson Plan for T2T Capstone Observation

*The first three pages are blank for you to fill out. The end of the document has further guidance and examples for your reference.*

### Logistics

| | |
|---|---|
| Your Name: | Jennifer Reddig |
| Observation Number: | 1 |
| Observation Date: | 6/5 |
| Course Number and Title: | CS3600 Introduction to Artificial Intelligence |
| # of students enrolled in course: | 45 |
| # of students you estimate will attend lesson: | 30-ish |
| Room configuration: | Lecture style hall |

### Contextual Information for observers

*What information would be useful for an outside observer to be aware of?*

This is the second of three AI topics – reasoning under uncertainty. We have previously covered value and policy iteration as a global, pre-processing method. This is an introduction to a specific form of reinforcement learning – q-learning. We've spent a couple of days on MDPs and doing pre-processing through value and policy iteration to optimize a policy. Today we're learning how to estimate the utility of actions through trial and error.

### Specifically requested feedback

*What are you hoping to gain from this observation? What areas are you especially interested in getting feedback?*

We're doing an activity at the end of class to simulate AI decision-making from a first-person perspective. This is a new activity I created, and I would like feedback on conducting it and the subsequent reflection discussion. I try to activate and build on student prior knowledge and intuition and try to formalize it so they can build a computer program that can come to the same conclusions that they do as a human.

## Overall Course Goals

| List course goal in each row (add rows if necessary) | Does the lesson below address this goal? |
|---|---|
| 1. Apply search algorithms to design agents that navigate efficiently through various environments. | No |
| 2. Implement reward-based reinforcement learning algorithms in dynamic and uncertain conditions. | Yes |
| 3. Use probabilistic methods to localize and direct an agent in stochastic scenarios. | No |
| 4. Develop a probabilistic language model and evaluate its effectiveness. | No |
| 5. Implement deep learning models in Python using the TensorFlow library and train them with real-world datasets. | No |
| 6. Critically assess ethical implications and biases in AI systems, proposing solutions to mitigate these biases. | No |
| 7. Develop the confidence to ask questions. Every question is valuable and contributes to our shared learning journey. | Yes |
| 8. Cultivate the skills necessary for effective debugging. Each error is a steppingstone toward mastery – learning to troubleshoot thoughtfully is a key part of becoming a proficient AI practitioner. | No |
| 9. Develop the ability to seek out resources, research AI concepts, and take ownership of your learning. Learning to explore independently will prepare you for lifelong growth. | No |
| 10. Participate actively in group discussions and collaborative activities. Contribute, listen, and share your knowledge and questions openly. | Yes |
| 11. Build a growth mindset. I want to help you build resilience and confidence. | Yes |

## Specific Lesson Topic

*Write topic here:*

| |
|---|
| Reinforcement Learning through Q-learning |

## Specific Lesson Learning Objectives

*By the end of class, students will be able to:*

1. Interpret the components of the Q-learning update rule, including learning rate, discount factor, and reward.
2. Apply the Q-learning algorithm by hand.

3. Describe how the Q-table evolves over time.
4. Analyze how hyperparameters affect learning performance.
5.

## Assessment

*How will you assess student learning?*

| Learning objective # | Assessment Plan |
|---|---|
| 1, 3, 4 | In-class discussion (formative) |
| 2, 3 | Q-learning activity (formative) |
| 1, 3, 4 | Canvas reflection submission (formative) |
| 2 (course objective 2) | Project 2 (summative) |
| 2 (course objective 2) | Midterm Exam (summative) |

## Agenda

*This is the order of activities or topics that you will do during the lesson. This should be a play-by-play of "the run of the show."* ***Be detailed because this is where it all comes together****. Connect activities to learning objectives and indicate when you will conduct assessments during the lesson.*

| Time Increment | Activity / Topic / Section | Learning objective # |
|---|---|---|
| 9:30 | Students individually play a maze game with lots of death traps that restarts them at the beginning | |
| 9:40 | Discuss students experience and approaches, relate back to reinforcement learning | |
| 9:50 | Formally introduce reinforcement learning and how we update the bellman equation for repeated trials | 1 |
| 10:15 | Trace q-learning agent by hand | 2 |
| 10:30 | Demonstrate Q-learning collaborative activity | 2, 3 |
| 10:35 | Students simulate q-learning through several environments | 2, 3 |
| 11:00 | Discussion about early, mid, and late experience | 3 |
| 11:10 | Use Desmos simulation to examine the effect of each hyper parameter | 4 |
| 11:20 | Group discussion on each hyper parameter | 1, 4 |
| 11:30 | Complete Canvas Reflection and feedback | 1, 2, 3, 4 |
| 11:40 | Dismissal | |

## Student and Instructor Preparation and Follow-up

| | Before class | After Class |
|---|---|---|
| I need to… | • Prepare maze game and print outs<br>• Create slides<br>• | • Review student reflections<br>• |
| Students need to… | • Bring laptops<br>• | • Complete Assignment 2-B on Q-learning<br>• |

## Materials and Supplies

*Be sure to note who brings each item if you are expecting that students or the lead instructor contribute to the specific supplies of this lesson.*

- Printed mazes
- Whiteboards for q-learning activity
- Whiteboard markers
- Dice for random exploration
- 

## Contingencies

What will you do if you have extra time?

Continue discussion but relate hyper-parameters to the activity. Epsilon for exploration vs exploitation into epsilon-decay, learning rate adjustments for convergence, and future reward discounts.

Show a video of q-learning agents learning over time

Demonstrate q-learning environments with OpenAI Gym

What will you cut/alter if you are running behind?

Move the hyper-parameter review to the next class day

What are one or two things you worry might happen that would require you to change gears? What is your backup plan if those occur?

If students are not talkative in the full class discussion, switch to small groups and use TAs to encourage discussion, then share out findings

## Lesson Plan 2

# Lesson Plan for T2T Capstone Observation

*The first three pages are blank for you to fill out. The end of the document has further guidance and examples for your reference.*

### Logistics

| | |
|---|---|
| Your Name: | Jennifer Reddig |
| Observation Number: | 2 |
| Observation Date: | 6/24 |
| Course Number and Title: | CS3600 Introduction to Artificial Intelligence |
| # of students enrolled in course: | 42 |
| # of students you estimate will attend lesson: | 30-ish |
| Room configuration: | Lecture style hall |

### Contextual Information for observers

*What information would be useful for an outside observer to be aware of?*

This is the third lesson in our series on reasoning under uncertainty. We've previously covered probability fundamentals, Bayes Nets, and Inference by Enumeration. Today's class introduces Markov models, both observable and hidden. The lecture includes a simulation game to help students intuitively understand the structure of transitions and observations, and inference involved in Hidden Markov Models.

### Specifically requested feedback

*What are you hoping to gain from this observation? What areas are you especially interested in getting feedback?*

I'd like feedback on how well the game helps students build an intuition for the model, and later formalizes it with math.

### Overall Course Goals

| List course goal in each row (add rows if necessary) | Does the lesson below address this goal? |
|---|---|
| 1. Apply search algorithms to design agents that navigate efficiently through various environments. | No |
| 2. Implement reward-based reinforcement learning algorithms in dynamic and uncertain conditions. | No |
| 3. Use probabilistic methods to localize and direct an agent in stochastic scenarios. | Yes |
| 4. Develop a probabilistic language model and evaluate its effectiveness. | Yes |
| 5. Implement deep learning models in Python using the TensorFlow library and train them with real-world datasets. | No |
| 6. Critically assess ethical implications and biases in AI systems, proposing solutions to mitigate these biases. | No |
| 7. Develop the confidence to ask questions. Every question is valuable and contributes to our shared learning journey. | Yes |
| 8. Cultivate the skills necessary for effective debugging. Each error is a steppingstone toward mastery – learning to troubleshoot thoughtfully is a key part of becoming a proficient AI practitioner. | No |
| 9. Develop the ability to seek out resources, research AI concepts, and take ownership of your learning. Learning to explore independently will prepare you for lifelong growth. | No |
| 10. Participate actively in group discussions and collaborative activities. Contribute, listen, and share your knowledge and questions openly. | Yes |
| 11. Build a growth mindset. I want to help you build resilience and confidence. | Yes |

## Specific Lesson Topic

*Write topic here:*

| |
|---|
| Reasoning Under Uncertainty through Time: Markov Models |

## Specific Lesson Learning Objectives

*By the end of class, students will be able to:*

6. Compute probabilities from a transition matrix.
7. Infer the state probability distribution several time-steps into the future.
8. Describe the components of a Hidden Markov Model (HMM).
9. Infer hidden states from observations using a simplified belief update process.
10. Reflect on the limitations of decision-making under uncertainty.

11. Represent a Markov Model in python code.

## Assessment

*How will you assess student learning?*

| Learning objective # | Assessment Plan |
|---|---|
| 1, 2, 5 | Partner exercises (formative) |
| 3, 4, 5 | Two Spies Game (formative) |
| 3, 4, 5 | Canvas reflection submission (formative) |
| 6 | Jupyter notebook sandbox (formative) |
| 6 (course objectives 3-4) | Project 3 (summative) |
| 2, 4, 5 (course objective 3-4) | Final Exam (summative) |

## Agenda

*This is the order of activities or topics that you will do during the lesson. This should be a play-by-play of "the run of the show."* ***Be detailed because this is where it all comes together****. Connect activities to learning objectives and indicate when you will conduct assessments during the lesson.*

| Time Increment | Activity / Topic / Section | Learning objective # |
|---|---|---|
| 9:30 | Announcements | |
| 9:35 | What does it mean for variables to be independent?<br>Definitions and practice exercises in pairs | |
| 9:45 | Markov Chains: definitions | 1, 2 |
| 9:55 | Predicting future state distributions in pairs | 1, 2 |
| 10:00 | n-gram language models and Project 3 instructions | 1, 2 |
| 10:05 | Hidden Markov Models | 1, 2, 3 |
| 10:10 | Two Spies simulation game | 3 |
| 10:30 | Debrief: how do you make decisions under uncertainty? | 5 |
| 10:40 | Formalize the game into matrices | 1, 3 |
| 11:00 | Inference of hidden states through observations<br>Example by hand, Bayesian Knowledge Tracing | 2, 3, 4 |
| 11:10 | Canvas reflection and feedback | 5 |
| 11:20 | Review Midterm Exam | |
| 11:40 | Dismissal | |

## Student and Instructor Preparation and Follow-up

| | Before class | After Class |
|---|---|---|
| I need to... | • Bring dice and city map handouts<br>• Create slides<br>• | • Review student reflections<br>• Clarify misconceptions in the next class session |
| Students need to... | • Bring laptops<br>• Review prior notes on conditional probability, Bayes Nets, and MDPs | • Complete Assignment 3-A on Bayes Nets<br>• Complete Assignment 3-B on n-gram language models<br>• |

## Materials and Supplies

*Be sure to note who brings each item if you are expecting that students or the lead instructor contribute to the specific supplies of this lesson.*

- Dice
- City maps
- Two Spies handouts
-

## Contingencies

What will you do if you have extra time?

Do additional time-steps of BKT calculations by hand

What will you cut/alter if you are running behind?

BKT stuff, we can do inference by hand on Thursday

What are one or two things you worry might happen that would require you to change gears? What is your backup plan if those occur?

If students are not talkative in the full class discussion, switch to small groups and use TAs to encourage discussion, then share out findings

# Evidence of Effective Teaching Reflection 1

This lesson started with a warm-up activity. Students played a maze game. This maze had many death traps and each time you die, you restart at the beginning. I wanted to use this game to draw similarities between their experience learning the path and reinforcement learning. In Q-learning, the specific type of reinforcement learning this lesson is on, you have many 'episodes', where each episode is one attempt at exploring the world and finding the goal. Each attempt gives you new information that you can use to inform future attempts, which is exactly what students are doing as they explore the maze. One student even began taking notes on which actions are good and bad, which is exactly what a Q-learning agent does with their Q-table. After they play the maze, I ask them to reflect on their experience to and encourage them to elaborate until they say important reinforcement learning concepts. Then, I formalize reinforcement learning and add the points that they did not mention in their maze reflection. We learn how to find an optimal policy through repeated trials instead of pre-processing, so we modify the value iteration formula to account for multiple explorations. Then we play a group activity. A common error I see from students when learning this concept is that they know how to use a completed Q-table, but not how to build a Q-table. The Q-agent combines multiple random explorations to arrive at an optimal policy. As humans, we cannot forget the last episode to do a true random exploration. So, I let each student be one episode in an environment they had never seen before, so it was truly un-informed exploration. This way, each student got the experience of truly uninformed exploration in early stages and in late states. They experienced what the q-table looks like before it's fully populated and what it looks like when it has converged to an optimal policy. Once we completed our explorations on the worlds, we debriefed the experience of first-person Q-learning decision-making. Students commented on how they didn't know what to exploit when the Q-table was all zeros, which is one of the main points I wanted to communicate through this experience. Many students write their Q-learning code to only take the maximum of the Q-values, but this approach only works when the Q-table is fully populated. Random exploration is required to populate a Q-table that you can exploit. Finally, we downloaded a Jupyter notebook that allowed us to experiment with different parameter values. Students worked individually and experimented in the notebook to figure out what impact each parameter had on the agent's behavior. We debriefed after the lesson and recap-ed what each parameter does and what reasonable ranges look like for each value.

Based on the feedback I received, this was a very successful approach to the lesson. The pacing was good, students got to digest each part of the lesson before applying it to the next segment. The main area of improvement is how I structured by class debrief after the activities. Not every student participated in the debrief and the reflection process is more valuable when everyone gets to take part. I have mixed feelings about this point. As a student, I really dislike being forced to speak. I am a very personal person and will absolutely keep up with the class and do my own internal reflection, but I don't like sharing that internal, personal process. When asked to do a think-pair-share, I often go for more surface-level findings rather than share something personal that I find more profound. As a teacher, I do want to know what's going on in each of my student's heads, but I would never want to ask them to do something that I would be uncomfortable with as a student. For this reason, all of my 'participation' and 'attendance' grades are something that can be completed individually and asynchronously. Students can go as deep or as surface as they like in their one minute paper reflection. The participation component has been something I've struggled with since my undergrad, and I think I've reached a place where I'm getting a good perspective of my students' learning without having them do something that I would dislike as a student.

As far as lesson structure goes, my learning objectives were well-aligned with the actual lesson structure, and each objective had a formative assessment point during the lesson, as well as summative assessments later in the course timeline. My instructional strategies are based on constructionism and discovery learning. I never want to just tell my students something that they could experience. The feedback I received indicates that this is a very successful strategy that engaged students in their own learning. Because of this, my classroom climate is a warm one, that encourages trial and error and experimentation to discover the content. I always make sure I check in with each student to make sure they're keeping pace and having run into any technical or content difficulties. I also received feedback on my presentations. I always include any instructions I say out-loud on the slides so students have multiple paths to understanding the activity. The observers thought my transitions were strong between each section and my directions were clear and easily understandable.

My main teaching philosophies are discovery-based learning, experimentation, and constructionism. Because of this, I use lots of active, game-based learning in class. I want to build student intuition for AI decision making before we formalize it with math. I like to provide activities that put students in a first-person view of how AI makes decisions, and then show them how we can operationalize the rules of the world so a machine can arrive at the same conclusions they did. In practice, my methods are closely aligned with my teaching philosophies. Especially in a survey class, intuition is important rather than complete mastery over the algorithms. My class sessions are built around giving students the confidence and understanding to try to understand AI methods. I regularly include checkpoints where students can submit their current understanding to me so I can judge what parts they're missing. This gives me a daily perspective into their understanding so I can adjust my instruction as students learn.

I do think I can improve on how I encourage my students to engage in metacognitive reflection. Learning can be challenging and reflecting on your progress and understanding and methods is tough to learn how to do. Instead of just reflecting on the concept, I could encourage my students to think about how the activity or lesson reinforced the concept and what parts they still need to review.  Learning how to learn is just as important as learning the concepts. Perhaps even more valuable as it sets students up for a lifetime of learning, instead of just the course topics.

# Evidence of Effective Teaching Reflection 2

The main goal of this lesson was to give my students the experience of having to make decisions with incomplete information, so they would have to infer the most likely state. The project for this section has students coding an AI agent that wanders through a house, collecting sensor readings of a hidden ghost. The ghost cannot be seen, only felt through noisy sensors. Students must use probability to infer the most likely location of the ghost given many noisy readings. I wanted to give them a first-hand experience of inferring the location of a hidden object. Students came into class already having experience inferring static objects using Bayesian Networks, but now the object will also be moving.

We started by reviewing the concept of conditional independence and derived that in a Markov chain, you only need the previous time step. Given the previous timestep, the current time step is independent of everything that came before, so we can estimate the transition of a state machine using the transition model. Then we added sensor readings of a Hidden Markov variable and derived that we can infer the current state using only the transition model and sensor model. Before doing any math, I introduced a small game. Students were to track a hidden spy through a country, taking turns at being the hidden spy or the hunter. The hidden spy gave their partner coarse sensor reports of their location as they moved through the country, while the hunter spy tried to end up in the same location to capture the hidden spy. The hidden spy is the Hidden Markov variable, with a clear transition model and sensor model. The hunter spy is the AI agent performing inference. After students played a few rounds of the game in each role, we discussed their experience both acting as the Hidden Markov variable and the inferring AI agent.

Next, we defined the transition matrix and sensor matrix for this game and performed one step of inference by hand. Then we downloaded a Jupyter Notebook and coded up the exact calculations to simulate the Hidden Markov variable and use the sensor readings to infer the location. By doing it in code, we can see what decisions are hard to make, which confirmed the students' intuition on what information they needed to be sure about their inference.

My feedback reinforced that this was an engaging and effective activity. I connected the activity clearly to the main learning objectives. My slides used visuals and the space effectively to make the point of each slide clear. I also used wait time to encourage student participation. My observers did remark that my lesson would benefit from being explicit with my learning objectives at the start of the lesson and give students more time with simple Markov Chains before moving on to more advanced Hidden Markov Models. I definitely agree that I could have spent more time on Markov Chains. However, given the constraints of the shorter summer semester, and that the coding assessment is focused on

HMMs, not Markov Chains, I do think I balanced the session appropriately given how the student assessment is weighted. Perhaps during a longer fall or spring semester I could spend more time on Markov Chains, but I feel my choice was justified and appropriate given the context.

I have mixed feelings about being explicit up-front about the learning objectives. Giving students the day's objectives early lets them know what to pay attention to during the class (or what they can skip). I do provide students with an agenda of what we are going to do today, but because I prioritize discovery experiences, I'd rather state the learning objectives after the learning activity as to not spoil the discovery. Students can still use the learning objectives to self-assess and reflect on what was most important about today's lesson, but after the activity is over. I would also never end the lesson without telling my students what they were supposed to discover. However, sometimes I feel it isn't appropriate to be up-front with the specific objectives, since that leans more into telling rather than showing.

My learning goals and assessment strategies were tied closely together. I spent the majority of class focused on concepts that students will use in their technical summative assessments. I also used formative assessment to solicit feedback on how my students' learning was progressing. My instructional strategies alternate between short lectures, collaborative problem-solving, games, and reflections. In this lesson I alternated a few times between lecture and collaborative problem-solving, then transitioned into a game and reflection, followed by one more cycle of lecture, problem-solving, and reflection. This keeps my students engaged and thinking critically the entire class period. My observers also commented on how welcoming my classroom is. They found I was approachable and many students asked me questions as I checked in with each group walking around the room.

This lesson was also a great example of my personal teaching philosophies. Discovery and building intuition are two of my main goals when teaching. This lesson had both of these elements. Students reasoned through conditional independence using what they know about Bayesian Networks and applying it to networks that represent transitions through time. They proved to themselves why the current time step is independent given the previous time step instead of me stating this fact as a given. They also built intuition for how inference works by reasoning through the hidden spy's location given several sequential observations. They used their inference to make decisions about where their AI should move. They used both of these pieces in their summative programming assignment. The games and exercises in this lesson were active methods for learning Hidden Markov Models. I also supportive an inclusive, welcoming class culture by checking in with each student several times as they worked independently or in groups. I try to spend as little time in the front of the room as possible, and prefer to organize activities that the students can run while I work with those that need the most help. The reflections students complete after the activity ask them to think about what they know and how today's activities helped them learn it. These as well as the other formative assessments like artifacts and worksheets are evidence of my successful teaching practices.

The next time I teach this lesson, I want to make sure I give students the opportunity to explicitly state how HMMs work before we do the math. I want them to come up with their own formalization for this process, and then reinforce it with mathematics. This will help make the connection between the activity and the content clearer. I also need to be more mindful about documenting evidence. Since I spend so little time at my computer, I often forget to note down important evidence, questions, or changes throughout the lesson. If I kept a notebook or my iPad at the ready, I could do a better job of remembering different points instead of trying to remember the entire 2-hour class at the end.

# Peer Review 1

**Presenter's Name: Tantan**

**Context for lesson (e.g. course level, class size, etc.): MATH1711, small but active class, first years**

**Specifically requested feedback: instructor persona, problem-based learning, differentiating pacing**

*Note: Think about the most significant aspects of teaching that you observed (using the categories below as potential prompts). What was effective/ineffective? Why?*

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LEARNING GOALS AND ASSESSMENT

*Does the instructor provide specific, clear learning objectives? Does the instructor then teach towards these objectives? Has the instructor gathered evidence of student learning?*

Yes, the lesson has specific learning objectives and teaches toward those objectives. Tantan gathers evidence of student learning by working with each student individually.

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INSTRUCTIONAL STRATEGIES

*Do the chosen instructional strategies seem to support the learning objectives and assessment? Are there areas where slides, handouts, explanations, student interaction, etc. could be improved?*

I really like the guided notes. This is a great tool for this group of students to learn how to take notes and not miss any important content. Way to build soft skills!
The instruction is very personal, frequent pauses for questions and discussion and group work.

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CLASSROOM CLIMATE

*Does the instructor create a positive learning environment in which all students are comfortable participating?*

A culture has been set, and students clearly know what is expected of them when they enter the room. Most students participate and ask/answer questions during whole class instruction. All students converse with each other about the content when working in small groups. Tantan presents herself in a very approachable, casual manner

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PRESENTATION

*Do the structure, pace, transitions, visual aids, and verbal/nonverbal communication support learning?*

Tantan takes the time to work with students individually, tailoring the pace of the class to student needs. She adjusts the pace and schedule based on the student experience, accounting for confusion and questions.

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**Prioritized Feedback**

1. What do you think was the one most effective aspect of the teaching demonstration?

   Each student got personal attention from the instructor. What a special environment!

2. What do you think is the most important consideration for the presenter's future teaching?

How will this scale to future instructional environments? You have a very intimate environment with lots of personal attention, but how will your techniques scale?

# Peer Review 2

**Presenter's Name: Chase Sun**

**Context for lesson (e.g. course level, class size, etc.): ME 4056, 23 students in class**

**Specifically requested feedback: Implementation of teaching practices**

*Note: Think about the most significant aspects of teaching that you observed (using the categories below as potential prompts). What was effective/ineffective? Why?*

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LEARNING GOALS AND ASSESSMENT

*Does the instructor provide specific, clear learning objectives? Does the instructor then teach towards these objectives? Has the instructor gathered evidence of student learning?*

Announced learning objectives at the start of the class
Re-iterated learning objectives after each one was covered
Learning objectives are assessed through whole class discussion, but not on the level of individual students during class. The out-of-class homework and report will assess if students have achieved these learning objectives.

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INSTRUCTIONAL STRATEGIES

*Do the chosen instructional strategies seem to support the learning objectives and assessment? Are there areas where slides, handouts, explanations, student interaction, etc. could be improved?*

Asks for thumbs up/down at checkpoints
I wonder if after each learning objective is covered in class, you might pause to evaluate if students can actually do it following the instruction?
The prediction exercise is a fun way to activate prior knowledge, and the discussion afterward connected it to the learning objectives.
Students were very engaged when asking questions about the formula/equations, and it sounded like (from Chase's reaction) they were good questions that focused on clarifying understanding and extending the lecture.
Really nice recap at the end, students are making good predictions (15 answers), leading to an informative discussion

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CLASSROOM CLIMATE

*Does the instructor create a positive learning environment in which all students are comfortable participating?*

Chase exerts a very warm personality, smiles a lot, and is very encouraging to students who speak up. Students did participate in the padlet, even though they did not speak up (18 answers). Students took about 30 minutes to warm up (or wake up) to start answering and asking questions, but once they did, they were very active and inquisitive. There were some students who did not speak at all the entire class.

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Most students are just attentively listening, no notes, no devices, pure attention. Many students who do have devices are on-task taking notes or referencing class slides. A couple of times they go off-task but always return to the lecture after a few minutes. It's clear that Chase has motivated the importance of the content and students see the value and are genuinely interested.

PRESENTATION

*Do the structure, pace, transitions, visual aids, and verbal/nonverbal communication support learning?*

Nice voice modulation and speaking pace, very easy to listen to and understand from an outside perspective.

Regular stops every 10-ish minutes to check in with students or ask students to participate/engage.

Good animations on the slides to demonstrate derivation. Allows for discussion on how later information impacts earlier understanding/information.

**Prioritized Feedback**

3. What do you think was the one most effective aspect of the teaching demonstration?

   I really enjoyed the Q&A parts. The students had loads of good questions and were intrigued. Chase gave thorough answers and spent a lot of time on each student's personal issues. Chase also reserved time at the end of class to talk 1-1 with any students that had questions they didn't want to ask.

4. What do you think is the most important consideration for the presenter's future teaching?

I know there's a lot of high stakes assessment after class, but it would be nice to see more assessment during class. Not many students participated in the thumbs up/down checks, and only 2/3-ish participated in the padlets.

# Faculty Interview Paper

**Interview Context**

I interviewed Dr Emily Jensen on 6/23/25. She just finished her first year as an Assistant Professor at Franklin & Marshall college in Lancaster, PA and is the only woman in her department. She completed her PhD in Computer Science and Cognitive Science in 2024 from University of Colorado, Boulder and also does educational technology research. There are five assistant professors and two associate professors in the CS department of F&M college. The college is a small liberal arts college in a small Pennsylvania town. As a Lancaster local myself, I wanted to hear about the state of academia in my hometown from someone with a similar background.

I interviewed Professor Nancy Reddig on 6/30/25[1]. She has held a full-time Lecturer position at Elizabethtown college for the last four years. Prior to being a full-time professor, she was an adjunct professor since 2015 at the same college, and before that, a high school teacher. Elizabethtown has three associate professors, one assistant professor, and one lecturer in their computer science department, two of whom are women. I was interested in talking to Nancy because her role is entirely teaching focused with no research component. As someone who got into academia looking to teach, this kind of role appeals to me.

**Interview Summaries**

Emily and I talked a lot about work-life balance and the difference between research at an R1 institution and a teaching institution. Since acquiring grants is not required for tenure, the professors focus more on improving the student experience through revising course content, improving pedagogy, and designing new courses. The teaching load is manageable, 5 courses throughout the year (usually a 3/2 split) and multiple sections of the same course count as separate courses. She also receives a lot of support from the school's faculty center. They have reading groups, and regular meetings for the new teaching cohort. Emily had not taught before starting this position, so she was surprised by how time consuming it was. Fortunately, her department chair told her not to worry about doing research her first year and focus on getting her feet under her. Overall, the institution shows how much they care about their teachers and students through support groups and giving their faculty time to reflect and improve on their teaching.

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[1] Yes, this is my mother. My second requested interview fell through and could not be rescheduled before the due date. However, we did talk about things we don't usually discuss, and it was an interesting perspective into what academic life is like without a PhD.

Nancy and I talked a lot about the requirements outside teaching and the troubles of an institution that doesn't bring in a lot of research funding. As the only Lecturer among Associate/Assistant Professors, she has no research duties. Instead, she has a larger teaching load than other faculty (15 credits per semester vs 12 credits per semester), and rarely does she get to share preps (i.e. every course she teaches is unique and doesn't have multiple sections). She also performs a lot of the student out-reach duties – attending prospective student visit days, running tours, and in the summer she leads a coding academy for high school students. Though her class sizes are small, she spends most of her time working on teaching duties, and the rest of the time completing service obligations. Because she spends so much time of service and student recruitment, she sees how much effort the college puts into bringing in students, since tuition is the primary source of funding. Nancy expressed concerns around job security since the college-aged population is declining, and there are several institutions in the same area that are competing for this limited student population. Much of the responsibility for innovating course content and new courses falls on her shoulders as a primary teaching faculty.

## Reflection and Synthesis

The three most important things I learned from these interviews are (1) how colleges support faculty in teaching-focused roles, (2) the financial pressures of small colleges, and (3) course development is a continual process. Both institutions offer paid opportunities for professors to build new course material or revise existing material. Both institutions are primarily funded by student tuition and have to work hard to compete for a decreasing student-aged population. And both professors never stop iterating on their courses; complacency leads to a poor student experience.

Emily and Nancy are in two different stages of their teaching career, but it surprised me that the majority of both of their time was taken up by course design. No matter where you are in your teaching career, you cannot get complacent, and you always need to be working to improve the experience for students. I think that's something that's missing from Georgia Tech's CoC department. Many courses have remained the same – same assignments, same lectures, same Udacity videos recorded in the 2010s. Since the focus is on research, providing a quality course experience is not a priority for many instructors, and just a service obligation to be fulfilled. Hearing how Elizabethtown and F&M prioritize quality education and the student experience made me more certain that I want to be a part of a community that prioritizes student learning. I was also surprised by how the institutions supported their faculty development. Giving teachers opportunities and funding to improve their courses outside of the school year instead of having instructors find spare time to improve (if they want to) was exactly the kind of support I was lacking in K12. I would love to be part of an institution that encourages faculty to innovate in the classroom.

However, an institution that relies solely on student tuition as its income does concern me a bit. I don't like the predatory practices in higher education that require young adults to put themselves into massive, potentially unrecoverable debt. I want higher education to be accessible and believe that everyone should have the opportunity to learn, but not at the expense of their financial stability or draining their parents' retirement funds. If I could bring in research grants to support myself and my students, then I could continue to teach without draining funds from 18-year-olds. However, I know that research grants do not offset the rising tuition costs. My stipend is nearly completely covered by research grants and yet tuition is still ~$30,000 per year, which is about how much a student at Elizabethtown college would pay per year, and what my tuition was at a small teaching institution in 2010. Had I not entered a service career and qualified for loan forgiveness, I would still be paying off these loans. Job security is a concern to both professors I talked to, and relying on teenagers to fund my lifestyle feels icky to me. I would hope that in a teaching position, I can offset that feeling by supporting my students and helping them to learn and grow into mature adults.

At this point in time, I don't see myself changing my trajectory, but it is nice to see that I could have a fulfilling academic life without finishing the PhD. Grant writing is something I don't have a lot of experience with, so it's also nice to hear that it's not necessary for tenure. I definitely excel at more teaching and service/outreach so I want my future institution to value those qualities in a professor.

# Revised Teaching Statement

**I bring nearly a decade of teaching experience to a computer science classroom.** For six years, I taught mathematics and computer science at the K-12 level, specializing in 6th grade Pre-Algebra, 9th grade Algebra II, and 12th grade AP Computer Science A. During my time at Georgia Tech, I served as a teaching assistant for a total of 8 semesters in a variety of topics: Graduate Introduction to Operating Systems (CS6200, three semesters), High-Performance Computer Architecture (CS6290, three semesters), and Undergraduate Introduction to Artificial Intelligence (CS3600, two semesters). As a teaching assistant, I tutored students 1-on-1 and in small groups, designed assessments, ran small group activities, and graded student work. I also completed my Tech to Teaching Capstone by serving as Instructor of Record for CS3600 Introduction to Artificial Intelligence, creating my own curriculum and publishing my activities in EAAI'26. I am a MathStreamer for Carnegie Learning, creating engaging instructional videos for K12 mathematics lessons. My research concentration in AI for Education was initially sparked by my love for teaching, but as I explore how representation can be used to personalize the student experience in technology, I find new ways to express and engage my students in the classroom.

**For lifelong success as a computer scientist or software engineer**, today's students will need to learn new languages on a fly, have a solid intuition for how computer algorithms work, and have strong independent debugging skills in order to design and build any piece of software. My pedagogy is guided by constructionism, the theory that learning happens by doing. I believe that the most long-term learning comes from discovering concepts for yourself. As a computer science instructor, my primary goal is to give students the experiences and opportunities they need to discover course concepts. I never want to simply tell my students something they could experience for themselves. I want to create opportunities for my students to try, experiment, fail, succeed, and learn. As I plan my instruction, I'm considering how to chunk the content, how to give my students opportunities to practice, when to insert formative assessment, how the students are going to interact with each other and with me, and how I will be measuring the success of my lesson. In this way, designing lessons for 6th graders is not so different from designing lessons for undergraduates, and I can apply my experience in the K-12 classroom to higher education. In both environments, I try to build a classroom where students are confident in their ability to learn, where the learning activities help my students gain an intuition for how computers make decisions and teach them expert debugging skills.

**For students to persist in a subject, they need to see themselves as capable of succeeding in it** (Steele, 1997, A Threat in the Air). This self-identification comes when students believe they can succeed and gain confidence in their abilities, making them more resilient to setbacks and more likely to continue learning. Especially in subjects like computer science and artificial intelligence, students can feel apprehensive about learning a highly technical subject that is often preceded by complicated mathematics. My goal is to create a safe, supportive environment where students feel free to try new things without fear of failure, and a space where they can see themselves having a future in the field. To achieve this, I design courses that provide accessible entry points to technical material, applying Universal Design for Learning principles and eliminating hidden curriculum wherever possible. I use physical analogies and games to make technical content easy and intuitive, before building a more precise, technical understanding. I try to leverage my student's current knowledge and expertise to build a deeper understanding of challenging content. I aim to give students early 'wins' so they see success is attainable, even if they initially do not see themselves as a computer person. My students have appreciated this approach, saying "*I truly believe she is the best professor ever. I've taken this class before [with a] different professor and the knowledge felt so unattainable, and I just couldn't follow. I thought it was me and that I was stupid, but here I am taking it again and it's all just so simple*". Another student shared, "*She explains concepts in a way a beginner could understand, so I never feel like I'm left behind*", and a third reflected, "*I really appreciate how she does around to everyone and makes sure everyone understands the concept individually as well, so no one feels left behind before class is over*." Outside observers remarked that "*your passion for the material and the relationship you have with your students is the most effective aspect of your teaching*". These comments reinforce my belief that classroom climate and individualized attention matter deeply, shaping how students see themselves and their potential in the discipline.

**What I want students to take away from my classes is an intuitive understanding of why things work the way they do**. With this intuition, students can more easily reconstruct the technical and mathematical details both during the course and later when applying the material in their career. When intuition comes first, the technical details become more meaningful. Most artificial intelligence methods are based on human intelligence, and students are already experts in their own decision-making. I use physical manipulatives, metaphors, and games to put students in a situation where they need to make an optimal decision under stochasticity or uncertainty, such as card or dice games. Through these activities, the world dynamics become clear and students can reason concretely, even when outcomes are uncertain. When we follow each activity up with a mathematical formalization of how AI would represent and process the problem, students can see how and why we formalize phenomena in particular ways, instead of seeing arbitrary definitions before grasping the big picture. Students have expressed how this focus on intuition helps them bridge the gap between theory and practice. One shared "*I* *really enjoy the activities we do in class. I think they've helped solidify my understanding of a lot of concepts that seemed very abstract. Tracing through small examples of these algorithms running on the board makes it easier to visualize and extrapolate them*." Another noted "*The simulated demonstration as well as the hands-on activity made the concepts less abstract, allowing me to learn them tangibly in a way.*" A third student said that "*the physical activities were really helpful to me since it let me physically model the actions an agent would take and learn about how it would practically work over just learning theory*". Building on my student's ability to reason about an activity makes the transition to abstract theory and technical details easier, and they now have a lived experience to tap into when using each concept in the future.

**Independent problem-solving is a skill that students will have to use in courses outside mine, and for the rest of their technical careers.** As an instructor, it can be so easy to pinpoint what a student is doing wrong from common bug rules, and the fastest way to solve student problems is to tell them what is wrong in their work. But having a student inspect their own work more thoroughly is a more valuable learning experience. Instead of telling students what is wrong, giving them hints about what to inspect, how to use a debugger, and encouraging them to think about what data structure they should investigate at what stages takes longer to solve their problems, but students will internalize these informal lessons. Through debugging together, students learn how to self-verify the correctness of their work, and how to fix their own problems independently. One student said "*She had super unique but effective ideas for debugging. She was genuinely interested in helping you solve your issue and not just giving you a solution to try. I have never met a TA this invested in the students and this good at what they do!"* This kind of feedback reassures me that students are not only learning to fix immediate problems but are also developing the mindset and skills to diagnose and solve their own problems independently.

**While course content is important, I also want to prepare my students for a future of lifelong learning.** My classroom prioritizes student confidence and well-being. I want to give my students the tools they need for success beyond my course, like computing intuition and independent debugging skills. I would enjoy teaching introductory classes like **Data Structures**, **Intro to AI/ML**, or **Algorithms**. I love being a student's first introduction to a subject, so I can show them how interesting this content can be and show them how they can see themselves as a computer scientist, an AI engineer, or an application developer. I would enjoy teaching cross-over classes like **Math for AI** or **Educational Technology**. Finding overlap between two topics makes content more meaningful and showing students how math is found in CS or how learning theories are evident in Ed Tech can help them see there's more to pursing a subject than pure CS theory. I would also enjoy going deep in a specific subject, like **High Performance Computing Algorithms** (applying parallelism to solve problems efficiently across multiple cores) or **Computational Models of Learning** (Bayesian Knowledge Tracing, Performance Factors Analysis, and AI that models human cognition). You'll find that I am an experienced educator with nearly a decade of teaching experience, enthusiastic about making higher education accessible.

# Capstone Reflection

Participating in the capstone has given me a more complete understanding of what it means to teach in higher education. I came into the capstone with extensive experience in lesson planning and general instruction in K-12, however I was not certain how well those skills would transfer to collegiate-level classes. I found that my instincts around chunking content, creating activities, classroom management, and my teaching persona were still applicable even to an aged-up audience. I naturally settled into a familiar routine of active, engaging lessons and the two-hour course block passed by quickly.

I did learn a lot about the unique responsibilities of a college instructor. The cultural norms of a college setting are different than the norms of a K-12 classroom. The rules surrounding attendance, the expectations around active participation, and the increased personal responsibility of students were all unfamiliar aspects that I had to adjust to. Managing an instructional team of TAs was also challenging. While I'm still learning how to manage these new attributes of higher education, I now feel more equipped to handle these challenges in the future.

One of the most meaningful aspects of this capstone was the opportunity to observe my peers and engage in discussions during our weekly meetings. Watching others teach exposed me to a variety of teaching styles, classroom environments, and department cultures that I would not otherwise encounter if I only focused on teaching within my department. It was eye-opening to see what teaching looks like in different departments and formats. I had the opportunity to observe large lectures, seminars, and lab settings. Watching my peers teach helped me think about how I might adapt my own teaching to different settings in the future. The observations also gave me the chance to reflect on what I value in my own instruction. Seeing the range of what 'good teaching' can look like let me reconsider aspects of my own teaching.

The weekly discussions with peers was perhaps the most valuable part of the entire experience. These meetings provided a safe and consistent space to process, troubleshoot, and share with others who were going through the same challenges. The collaborative setting helped normalize the ups and downs of teaching while we workshopped how to handle the variety of challenges teaching presents.

This experience has reinforced my desire to pursue teaching as part of my career. I now have a much stronger grasp of the college-specific responsibilities that come with the role of professor. I also got to apply all I learned from teaching K-12 to a new setting and try out my teaching persona in a new environment.