Student Generated Material for Artificial Intelligence Course (Work-In-Progress)

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Students often learn material more deeply by teaching it to other people. Therefore, the authors will modify an existing Artificial Intelligence (AI) course to include a new type of regular assignment: student-generated videos which will allow the students to be value creators within the course. Upper-level students will be creating 5-10-minute video lessons on introductory artificial intelligence topics as part of their regular homework during the course. The student videos will be shared with the other students in the course as both alternative lecture materials on these introductory subjects and to provide feedback. Students will be surveyed pre, mid, and post on their enjoyment of the homework assignments, if they videos improved learning, if they felt they learned from watching videos by other students, if they learn topics from videos, and if they like the format of the course. The authors believe that this addition to the course fosters many of the student objectives/outcomes for an entrepreneurial mindset. Currently, the authors are gathering preliminary feedback and data for a planned multiple semester longer term project. This paper contains (1) motivation and goals for this work, (2) outcomes and learning objectives, (3) instructions on how to design this kind of assignment, (4) the video assignment write up, (5) the rubric for the video, (6) the rubric for peer feedback, and (7) the rubric for reflection. This paper focuses on the structure and instruments used during the course.

About the Course

Artificial Intelligence (AI) is being used to tackle more and more of the real-world problems around us. EECS 4901 Special Topics: Introduction to Artificial Intelligence will introduce students to the fundamentals of Artificial Intelligence (AI). During this course students will look at various problems being solved by AI by studying software agents, problem solving by searching, various ways to represent knowledge, and methods of learning. Additionally, this course will discuss both the ethics and risks associated with the fields of AI. Topics covered during the course fall into 4 major categories: (1) Knowledge, Reasoning, Planning, and Uncertain Knowledge, (2) Learning and Philosophical Foundations, (3) Communicating, Perceiving, and Acting, and (4) Ethics and Risks. Previously, the authors have used the "flipped" classroom concept in courses. The flipped classroom, when mastered and done well, has been demonstrated to be beneficial to the students' ability to learn material [1]. One of the goals for this project is for students to help create a repository of material on artificial intelligence. Students will be learning material while creating their own videos as well as have videos created by other students to review the material.

Videos

During the semester, each student will generate four videos (one from each of the major categories listed above) with the opportunity tore-do one video based on instructor and peer feedback. Each video will be a 5-10-minute lesson on an introductory artificial intelligence topic. The students sign up for topics early in the semester in a first-come, first-serve manner one class period after the assignment was introduced during lecture. The schedule of due dates (~ 3 weeks between each video) was given at the start of the semester. Additionally, the due dates were selected specifically so the videos were created before topics were covered during lecture.

The aim of each video is to introduce the AI topic to other introductory AI students (i.e., their peers). The AI students can assume that the audience will have general knowledge about computers, computer science/computer engineering, and programming in C++/Java/other similar languages. The students can introduce the topic in any method that they wish. The students could film themselves "lecturing" on the topic, do a demonstration on the topic, pick a current event or interesting project on the topic, or any other creative ideas. The instructions were to be creative, make the video interesting to their peers, but stay rated PG. The assignment, as given to the students, can be found in appendix A.

Video Assignment

Students will be submitting either the video itself or a link to the video (via Google drive, private youtube channel, dropbox, etc.). Students will sign and submit a consent form regarding each video they create. This consent form will allow students to control the usage of their video: (1) use of video as part of the course by peers, (2) use of video to receive peer feedback, (3) use of video in video repository (via Engineering Unleashed), and/or (4) no use at all outside the grading context by instructor. The students can opt out of the video repository or being peer evaluated. (In that case the video will only be graded only by instructor and the instructor will provide all feedback). If students decline to participate in peer feedback, the alternative assignment will be to read an article discussing the importance of feedback and write up a short one paragraph reflection on the article.

The students will pick one video they created over the semester and revise this video based on the feedback from the instructor and fellow students. Additionally, they will submit a reflection with the revised video discussing how the feedback improved the video. At the end of the semester, the students will vote for the best video and the winning video will be awarded bonus points. Additionally, bonus points will be awarded for the most improved video.

Follow Up Assignments

There will be two follow up for each video: a peer evaluation assignment and a self-reflection assignment. In the peer evaluation assignment, students will be learning to provide constructive criticism. In the self-reflection assignments, students will be evaluating themselves and looking for ways to improve given provided feedback. Students will sign and submit a consent form regarding each peer evaluation that they submit. This consent form will allow students to (1) agree to allow the instructor to share their feedback anonymously with the video creator, (2) agree to allow the instructor to include their feedback with all the other feedback (i.e., overall combined score), and/or (3) agree to allow peer feedback on their feedback. The students can opt out of sharing their feedback with another student. (Given the small class size, the instructor felt that anonymous would not truly be anonymous). In this event, the instructor will provide the student with feedback regarding their peer evaluation.

Before any peer feedback occurs, students will receive guidelines for how to give constructive feedback and it will be paired with an in-class practice activity where they evaluate a video created by the instructor. The feedback will be broken into two sections: (1) elements that were

good about the video and (2) elements that need improvement in the video. The instructor will review all peer feedback before they are returned to students to make sure that guidelines are being followed. Failure to follow feedback guidelines will be reflected in the students' grade for that part of the assignment.

Student Outcomes / Learning Objectives

This course development is being supported by an internal KEEN Pedagogy Mini-Grant from Ohio Northern University. KEEN is a network of engineering faculty across many educational institutions dedicated to teaching undergraduate engineers how to create personal, economic, and societal value by having an entrepreneurial mindset [2 and 3]. The student generated content for this course, peer feedback, improvement video, and self-reflections are designed to assist students in improving their entrepreneurial mindset. Below are the specific KEEN course objectives [4] that students will gain with the completion of the assignments.

KEEN Related Course Outcomes/Learning Objectives [4]:

- Take ownership of, and express interest in topic/expertise/project.
- Present technical information effectively (graphs, tables, equations)
- Provide and accept constructive criticism, including self-evaluation.
- Produce effective verbal presentations
- Be able to teach and learn from peers.
- Modifies an idea/product based on feedback
- Demonstrate the ability to consider risk as a factor

Grade Distribution for Course

The entire course grade is designed to be out of approximately 1000 points. The videos and companion assignments are worth a significant portion of the grade. The logic behind this decision was to make them take notice so they would put effort into these assignments. The grade breakdown is as follows:

- **Videos, Feedbacks, and Reflections: 30%, ~300 points**
- Homework Projects: 35%, ~350 points
- Group Project and Paper: 10%, ~100 points
- Midterm Exam 10%, ~100 points
- Final Exam: 15%, ~150 points

Assessment Plan

Students will be surveyed pre, mid, and post term on their enjoyment of the homework assignments, if they felt they learned the material better, if they felt they learned from watching videos by other students, if they learn topics from videos, and if they like the format of the course. Additionally, the authors will be looking at the student grades in the course, on assignments, on projects, and exam scores on the related material. Data collection will take place over a minimum of three years (given the small class size < 10) in order to have enough data to

see trends. This first year will serve as a pilot to gain insight and feedback into the survey and assignment.

Below is the table containing KEEN framework category [3], KEEN related course outcomes [4], and the artifact(s) that will be used to assess each outcome. Appendix B provides the Instructor/Peer Video Rubric and Self-Reflection Rubric and appendix C contains the surveys given to the students.

Category of KEEN Related Course Outcome [3]	**KEEN Related Course Outcome [4]**	**Assessment Plan**
Related to Curiosity	Take ownership of, and express interest in topic/expertise/project.	Grade on Video
Communication	Present technical information effectively (graphs, tables, equations)	Grade from rubric on these portions of the video. (Material will be presenting material using the assertion-evidence style with a focus on visual evidence)
Communication	Provide and accept constructive criticism, including self-evaluation.	Grades/evaluation/improvements from instructor, fellow students, and self on the video
Communication	Produce effective verbal presentations	Grade from rubric on this portion of the video, Grade from fellow students on the video
Collaboration	Be able to teach and learn from peers.	Surveys/evaluation of the course (pre, mid, and post)
Creating Value	Modifies an idea/product based on feedback	Self-reflection submission with revised video and grade from rubric
Connections	Demonstrate the ability to consider risk as a factor	Grade from rubric for the video submission on ethics and risks of AI

Importance of Creating Videos

The KEEN organization and the authors believe that added an entrepreneurial mindset creates better engineers [2 and 3]. The KEEN framework contains the three C's: curiosity, connections, and creating value [3] which are the key skills needed to have an entrepreneurial mindset. By simply using videos found on YouTube, the students will not be practicing essential entrepreneurial mindset skills. The creating of the video is allowing the students to create course content, creating value, and be connected to the material covered in the course. The videos are designed to spark their curiosity and encourages them to make the content their own. Also, these skills are important given the recent shift to online delivered content of course material in light of the world-wide coronavirus pandemic. These types of assignments will hopefully help engage students and help them feel they are a part of the course.

Future Work and Next Steps

The authors plan to conduct preliminary research during the Spring 2020 term and gather student survey information, grades, course evaluation comments, etc. Using this information, the authors

will attempt to gain insight into the helpfulness of videos grade-wise. Given the small number of students taking the course (<10), most of the results are anecdotal and focuses on the experiment logistics working.

The authors plan to continue the study in future semesters of the introduction to AI course. Using this preliminary data and feedback to improve the course instruments used to collect the data. The next step is to expand the data pool to include student generated videos, survey responses, and grade information for other upper-level computer science course. Additionally, this will explore if the videos are helpful for multiple subjects and courses.

Resources

[1] J. L. Bishop and M. A. Verleger, "The Flipped Classroom: A Survey of the Research," 2013 *ASEE Annual Conference Proceedings, Atlanta, GA,* 2013.

[2] "KEEN - Home," KEEN - Home. [Online]. Available: https://engineeringunleashed.com/. [Accessed: 02-Feb-2020].

[3] *KEEN - The Framework*. [Online]. Available: https://engineeringunleashed.com/Mindset-Matters/Framework.aspx. [Accessed: 03-Feb-2020].

[4] J. B. Hylton, D. Mikesell, J.-D. Yoder, and H. LeBlanc, "Working to Instill the Entrepreneurial Mindset Across the Curriculum," *Entrepreneurship Education and Pedagogy*, vol. 3, no. 1, pp. 86–106, 2019.

Appendix A: The Video Assignment

Topics and Deadlines:

	Category	Topics	
1.	Knowledge, Reasoning, Planning, Uncertain Knowledge	1. Logical Agents 2. The Wumpus World 3. First-Order Logic 4. Inference in First-Order Logic 5. Classical Planning	6. Planning and Acting in the Real World 7. Knowledge Representation 8. Quantifying Uncertainty 9. Probabilistic Reasoning 10. Making Decisions
2.	Learning, Philosophical Foundations	1. Learning from Examples 2. Artificial Neural Networks 3. Machine Learning 4. Knowledge in Learning 5. Learning Probabilistic Models 6. Learning with Hidden Variables: The EM Algorithm	7. Reinforcement Learning 8. Applications of Reinforcement Learning 9. Weak AI: Can Machines Really Think? 10. Strong AI: Can Machines Act Intelligently?
3.	Communicating, Perceiving, and Acting	1. Natural Language Processing 2. Information Retrieval and Extraction 3. Natural Language for Communication 4. Speech Recognition 5. Perception	6. Object Recognition 7. Robotics 8. Robotics Hardware 9. Robotics Perception 10. Robotics Moving 11. Robotics Applications
4.	Ethics & Risks	1. Ethics of AI (in general) 2. Ethics of Developing AI 3. Ethics of Robots 4. Bias in AI Algorithms 5. Risks of AI 6. Risks of Robots 7. Are We Going in the Right Direction? 8. What If AI Does Succeed?	9. Ethics of AI and Data Privacy 10. Ethics of AI and Medical Field 11. AI & Quantum Computing 12. Ethics of Machine Learning 13. Social Implications of AI
5.	Improved Video via Feedback and Reflection	You may select any one of your 4 previous videos	

Instructions:

During the semester you will be creating a total of 5 videos each that are 5-10 minutes in length. The first 4 videos will be based on your selected topics above. The fifth video will be using your feedback and self-reflections to improve a video of your choice. The aim of each video is to introduce the AI topic to other introductory AI students (i.e., your peers). You can assume they have general knowledge about computers, computer science/computer engineering, and programming in C++/Java/other similar languages. You can introduce the topic in any method that you wish. You can "lecture" on the topic, you can do a demonstration, you can pick a current event or interesting project on the topic, etc. Whatever you think will be interesting to you and your peers. You can use pop culture, music, graphics, video games, animation, etc. Be as creative as you wish. Keep the videos G or PG rated.

In the peer evaluation assignment, you will be learning to provide constructive criticism and feedback. There is a rubric/feedback form that you will be completing for each video being evaluated. These will allow your peers to improve their videos, public speaking, and presentation skills. These are due 5-6 days after the video deadline. In the self-reflection assignments, you will be evaluating yourself and looking for ways to improve given provide feedback from the instructor (and your peers). Additionally, these self-reflections will allow you complete the final video project – which is improving one of your videos. These are due 4-5 days after the feedback is due. The reflection should be about a paragraph. **Did Someone Say Bonus Points?** At the end of the semester, everyone will vote for the best video and the winning video will be awarded bonus points. Additionally, bonus points will be awarded for the most improved video.

Appendix B: Instructor/Peer Video Rubric and Self-Reflection Rubric

(Scoring: 5 = Excellent, 4 = Great, 3 = Good, 2 = Ok, 1 = Needs Improvement)

	Grading Criteria (Video Rubric)	**Score (1-5 value)**	**Grading Criteria (Self-Reflection)**	**Score (1-5 value)**
1.	Did you enjoy the video?		Provide and accept constructive criticism, including self-evaluation?	
2.	Do you feel you learned the topic from the content of the video?		Modifies an idea/product based on feedback?	
3.	Do you feel the video covered the topic?		Self-Reflection was written professionally / appropriate manner?	
4.	Did the person conduct themselves in a professional / appropriate manner?		Appropriate / honest review of the student's performance?	
5.	Overall, was the style of video effective for teaching?		Overall, incorporated feedback from peers	
6.	Were visual aids, diagrams, code examples, charts, pictures helpful? Labeled, commented, & explained well?		Overall, incorporate feedback from instructor	
7.	Do you feel the length of video was appropriate?		Length/content was appropriate?	
8.	Did the video include the appropriate citations?			
9.	Was the presentation well organized?			
10.	Do you feel the video demonstrated the maker understood the topic?			
11.	Do you think the information in the video was accurate?			
12.	Did the student take ownership of, and express interest in topic/expertise/project?			
13.	Present technical information effectively (graphs, tables, equations)?			
14.	Produce effective verbal presentations?			

Suggestions for improvement?

Something liked/felt was well done:

Something that could be improved:

Appendix C: Survey to Students

		Please check one				
	Question	Strongly Agree	Agree	Neither / Undecided	Disagree	Strongly Disagree
1.	I can learn a computer science topic from a video.					
2.	Videos around 5 minutes are ideal to learn a topic					
3.	Videos longer than 10 minutes lose my attention					
4.	I can learn from student generated classroom content					
5.	I want to create course content for my classes					
6.	I want video supplement course content available					
7.	I like when homework assignments are different than the norm					
8.	I do not like getting feedback on my course work from my peers					
9.	I like assignments that allow me to research					
10.	I feel I learn better from videos than reading a textbook					
11.	I do not like grading my peers					
12.	I like the format of the course					