Using Jeopardy in an Undergraduate Required Business Analytics Course

BUTLER

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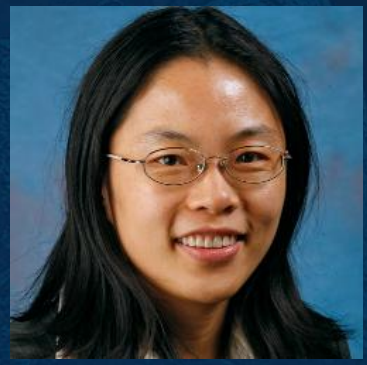

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We are proud of Butler BTA!

- How can we prepare **Business Technology & Analytics** (**BTA**) majors to land great jobs and have successful careers?
- How can we best serve our all our business students to become better data stewards and decision-makers?
- How can we accomplish these two tasks simultaneously?....

Various things we are researching...

NCAA MEN'S FINAL FOUR ANALYTICS CHALLENGE

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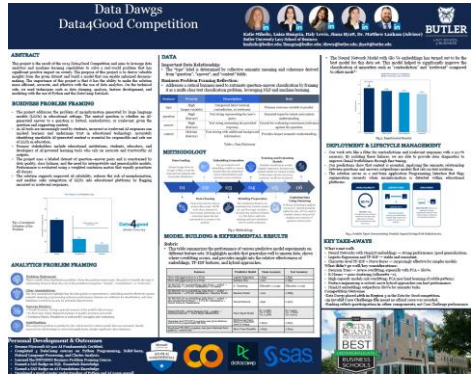

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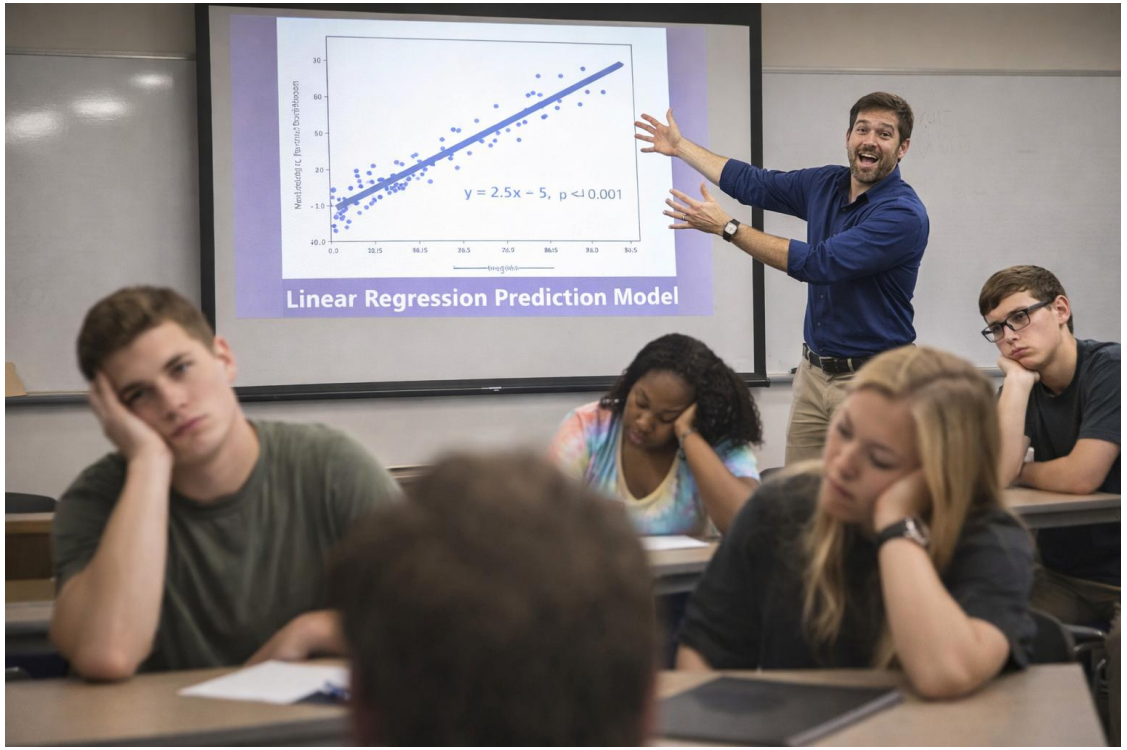
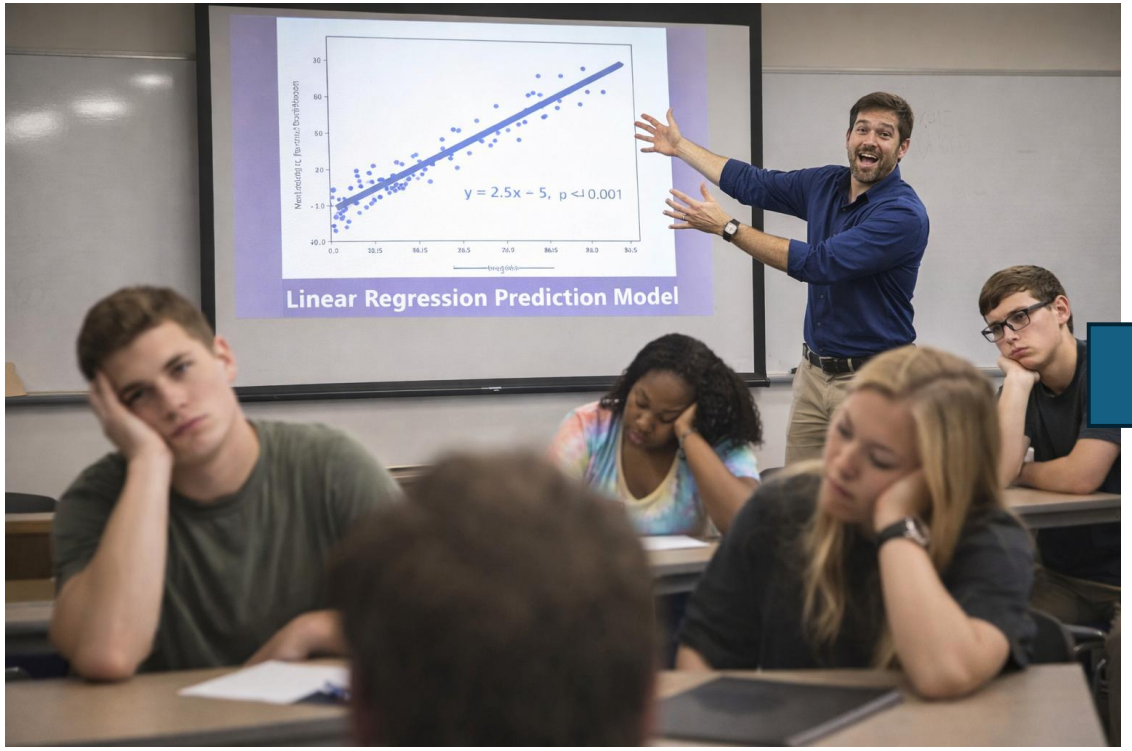
Motivation

- Business graduates are expected to be able to have improve data analytics skills today than in the past.
- Most academic programs require certain core business analytics courses that all business majors must take.
- Instructors may find discussion and measuring comprehension in such courses challenging for less technical majors.



Motivation

- In many required undergraduate courses, instructors struggle to balance coverage with engagement, particularly when material feels technical or abstract.
- Game-show formats such as Jeopardy have been proposed as one response because they are easy to stage, socially salient, and can surface misconceptions quickly.
- Prior implementations emphasize that the value of such games is not the scoreboard but the structured opportunities they create for students to externalize thinking, make claims, and negotiate reasons before an answer is revealed.



Using Jeopardy in Literature

1. In **engineering**, teams confer and defend alternatives, and the instructor uses answer-reveal **time to extend and clarify concepts**, an intentional shift away from speeded recall toward peer explanation and instructor synthesis (Gagnon 2012).

2. Empirical **results on learning are mixed but consistently positive on motivation**.

   - **Nursing and allied-health** studies report very high enthusiasm and perceived learning value (e.g., 96% motivated; 90% enjoyed), yet many designs are single-session and rely on instructor-authored surveys, which limits causal claims about achievement gains.

   - These studies **repeatedly note advantages for participation, cooperation, and comfort**, particularly for students who might otherwise remain quiet, and recommend facilitation choices (more response time; clickers or buzzers) that improve turn-taking and equity (Bayer-Hummel 2010).

Using Jeopardy in Literature

3. In the **natural sciences** suggest that under some conditions team **Jeopardy can lift performance**. A recent community-college biology study reported a statistically significant pooled-exam advantage for the Jeopardy term versus a prior-term control (67.7% vs. 59.4%, $p < .05$), while also noting that effect sizes varied by course and learning environment, evidence that implementation and context matter (Pathiraja and Ranasinghe 2024).

4. A multi-trial study in **business information systems** **found limited improvements on repeated-item tests, despite strong student enthusiasm**, an admonition that if questions remain recall-level and **facilitation does not elicit reasoning, achievement gains may be elusive** (Simkin 2013).

Research Questions

1. RQ1: After three discussion-centric Jeopardy sessions, to what extent do students perceive greater conceptual understanding than memorization?
2. RQ2: Can a Jeopardy tool be developed for instructors in a common-used language (e.g., python, R) with custom images?
3. RQ3: What level of student engagement is observed from using Jeopardy in class?
4. RQ4: How might students perform using Jeopardy to prepare for a standardized certification exam (e.g., Microsoft AI-900 certification)?

Methodological Design for Our Study

- A required undergraduate Predictive Analytics course for business majors at a small private university (N ≈ 58 across two sections).
- Students were randomized into six table teams (4–5 each).
- Each table had a physical answer buzzer to manage turns, but crucially the rule was that every answer (right or wrong) seeded a brief, instructor-facilitated whole-class discussion about model choice, assumptions, diagnostics, managerial trade-offs, and even the right tool to use.
- The Jeopardy board was implemented in Shiny (https://shiny.posit.co/) and driven by a spreadsheet of prompts, allowing low-overhead reuse and adaptation. While we used a version developed using the R language live in class, we also provide the same application coded in the Python language, for potentially wider audience use.

https://github.com/MatthewALanham/Jeopardy

Classroom

- 58 students (28 students in one course section; 29 in the other section). Students were randomly assigned to one of six teams where they would sit together at a specific table as shown in Figure 1.

Figure 1: Classroom design used in this study

Classroom

- Each table had one buzzer that a member from the student team could press to indicate they wanted to respond to a question, or respond to follow-up questions to the discussion as shown in Figure 2.
- Note: buzzers are not completely necessary, and an instructor could just identify first responders by raising their hand, but they did provide more of a game aesthetic. These buzzers were purchased on Amazon.com for ten to fifteen dollars each.

Figure 2: Buzzers used in this study

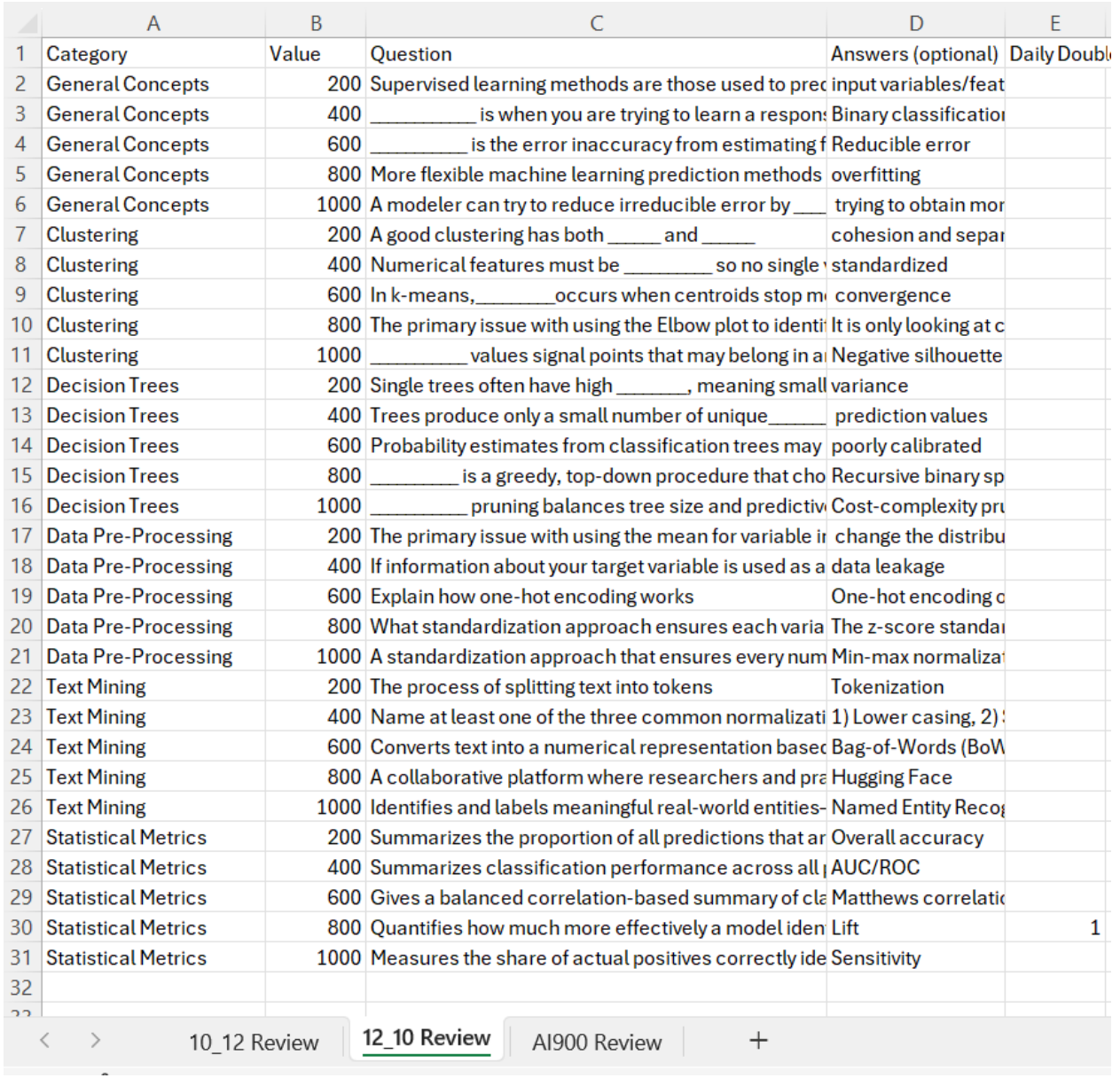
Jeopardy game board

In the real Jeopardy game, there are six categories with five questions within each category ranging from $200 to $1000. We designed the application interface to mimic that in style, color, and features to the actual game as shown in Figure 3.

Figure 3: Jeopardy Review front-end

Jeopardy game board

- The instructor can run the game board using RStudio or Python to run their Shiny application. They need not change any code.
- The backend, instructors would add their questions directly into a Microsoft Excel spreadsheet called **questions.xlsx** as shown in Figure 4.
- This is where one could change categories, values, and questions that they want to appear on the Jeopardy gameboard. What is helpful is that you can add a new tab in that spreadsheet with different sets of categories, values, and questions that you might use for future games or different class review days.
- The instructor would select those from the drop-down menu in the upper left-hand corner of the front-end interface.



	A	B	C	D	E
1	Category	Value	Question	Answers (optional)	Daily Doubl
2	General Concepts	200	Supervised learning methods are those used to prec	input variables/feat	
3	General Concepts	400	_____ is when you are trying to learn a respons	Binary classificatio	
4	General Concepts	600	_____ is the error inaccuracy from estimating f	Reducible error	
5	General Concepts	800	More flexible machine learning prediction methods	overfitting	
6	General Concepts	1000	A modeler can try to reduce irreducible error by ___	trying to obtain mor	
7	Clustering	200	A good clustering has both _____ and _____	cohesion and separ	
8	Clustering	400	Numerical features must be _____ so no single	standardized	
9	Clustering	600	In k-means,_____occurs when centroids stop m	convergence	
10	Clustering	800	The primary issue with using the Elbow plot to identi	It is only looking at c	
11	Clustering	1000	_____ values signal points that may belong in a	Negative silhouette	
12	Decision Trees	200	Single trees often have high _____, meaning small	variance	
13	Decision Trees	400	Trees produce only a small number of unique_____	prediction values	
14	Decision Trees	600	Probability estimates from classification trees may	poorly calibrated	
15	Decision Trees	800	_____ is a greedy, top-down procedure that cho	Recursive binary sp	
16	Decision Trees	1000	_____ pruning balances tree size and predictiv	Cost-complexity pru	
17	Data Pre-Processing	200	The primary issue with using the mean for variable i	change the distribu	
18	Data Pre-Processing	400	If information about your target variable is used as a	data leakage	
19	Data Pre-Processing	600	Explain how one-hot encoding works	One-hot encoding c	
20	Data Pre-Processing	800	What standardization approach ensures each varia	The z-score standar	
21	Data Pre-Processing	1000	A standardization approach that ensures every num	Min-max normaliza	
22	Text Mining	200	The process of splitting text into tokens	Tokenization	
23	Text Mining	400	Name at least one of the three common normalizati	1) Lower casing, 2)	
24	Text Mining	600	Converts text into a numerical representation basec	Bag-of-Words (BoW	
25	Text Mining	800	A collaborative platform where researchers and pra	Hugging Face	
26	Text Mining	1000	Identifies and labels meaningful real-world entities-	Named Entity Recog	
27	Statistical Metrics	200	Summarizes the proportion of all predictions that ar	Overall accuracy	
28	Statistical Metrics	400	Summarizes classification performance across all	AUC/ROC	
29	Statistical Metrics	600	Gives a balanced correlation-based summary of cla	Matthews correlatio	
30	Statistical Metrics	800	Quantifies how much more effectively a model iden	Lift	1
31	Statistical Metrics	1000	Measures the share of actual positives correctly ide	Sensitivity	
32					

10_12 Review | 12_10 Review | AI900 Review | +

Figure 4: questions.xlsx is where to add categories, values, and questions that you want to appear on the Jeopardy board

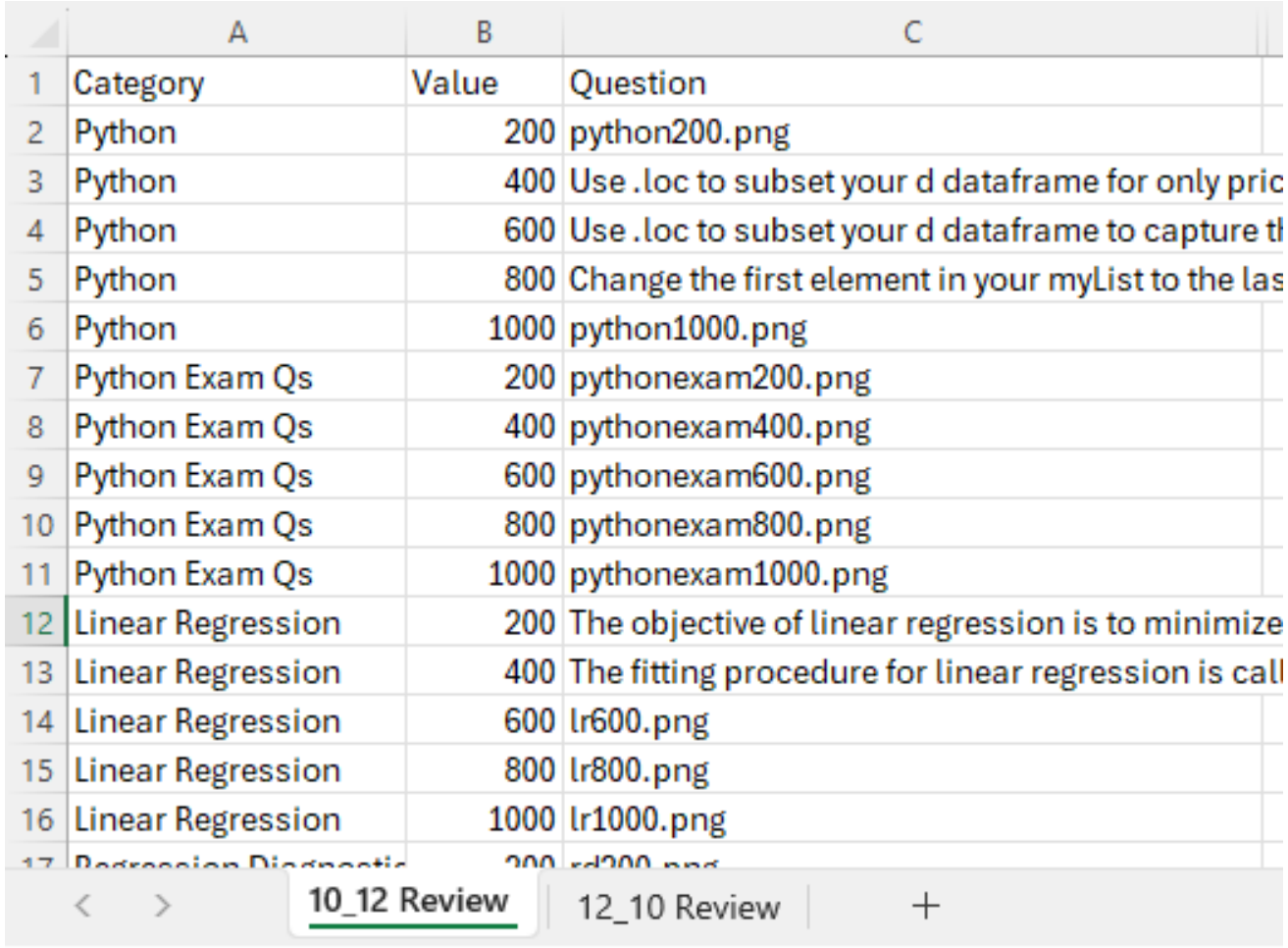
Jeopardy game board

- There are two different ways you can show questions to students which are important to guide discussion in the direction the instructor is intending.
- The first is the traditional question view. For example, selecting the Text Mining category with the $200 value reveals how text only questions will appear as shown Figure 5.
- This has a similar look-and-feel to the actual Jeopardy game.

Figure 5: Questions shown as text only

Jeopardy game board

- Sometimes it can be better to show a figure, code snippet, or screenshot from a previous lesson, instead of just text.
- The end-user would just save the image with the name they want and put it in the 'www' folder when they download the software from Github.
- For example, in the '**10_12 Review**' tab there are some questions that are saved as images (.png files) as shown in Figure 6 (e.g., python1000.png).



	A	B	C
1	Category	Value	Question
2	Python	200	python200.png
3	Python	400	Use .loc to subset your d dataframe for only pric
4	Python	600	Use .loc to subset your d dataframe to capture th
5	Python	800	Change the first element in your myList to the las
6	Python	1000	python1000.png
7	Python Exam Qs	200	pythonexam200.png
8	Python Exam Qs	400	pythonexam400.png
9	Python Exam Qs	600	pythonexam600.png
10	Python Exam Qs	800	pythonexam800.png
11	Python Exam Qs	1000	pythonexam1000.png
12	Linear Regression	200	The objective of linear regression is to minimize
13	Linear Regression	400	The fitting procedure for linear regression is call
14	Linear Regression	600	lr600.png
15	Linear Regression	800	lr800.png
16	Linear Regression	1000	lr1000.png

Figure 6: Some examples of using images as your questions instead of text only

Jeopardy game board

- If a student requested category Linear Regression for value $1000, the image lr1000.png found in the 'www' folder would appear on the screen as shown in Figure 7.
- For many courses, having statistical output to interpret, a code snippet to review, or various combinations with text can be very helpful for the instructor to narrow in on certain knowledge, skills, or abilities they want to discuss – possibly from different perspectives.

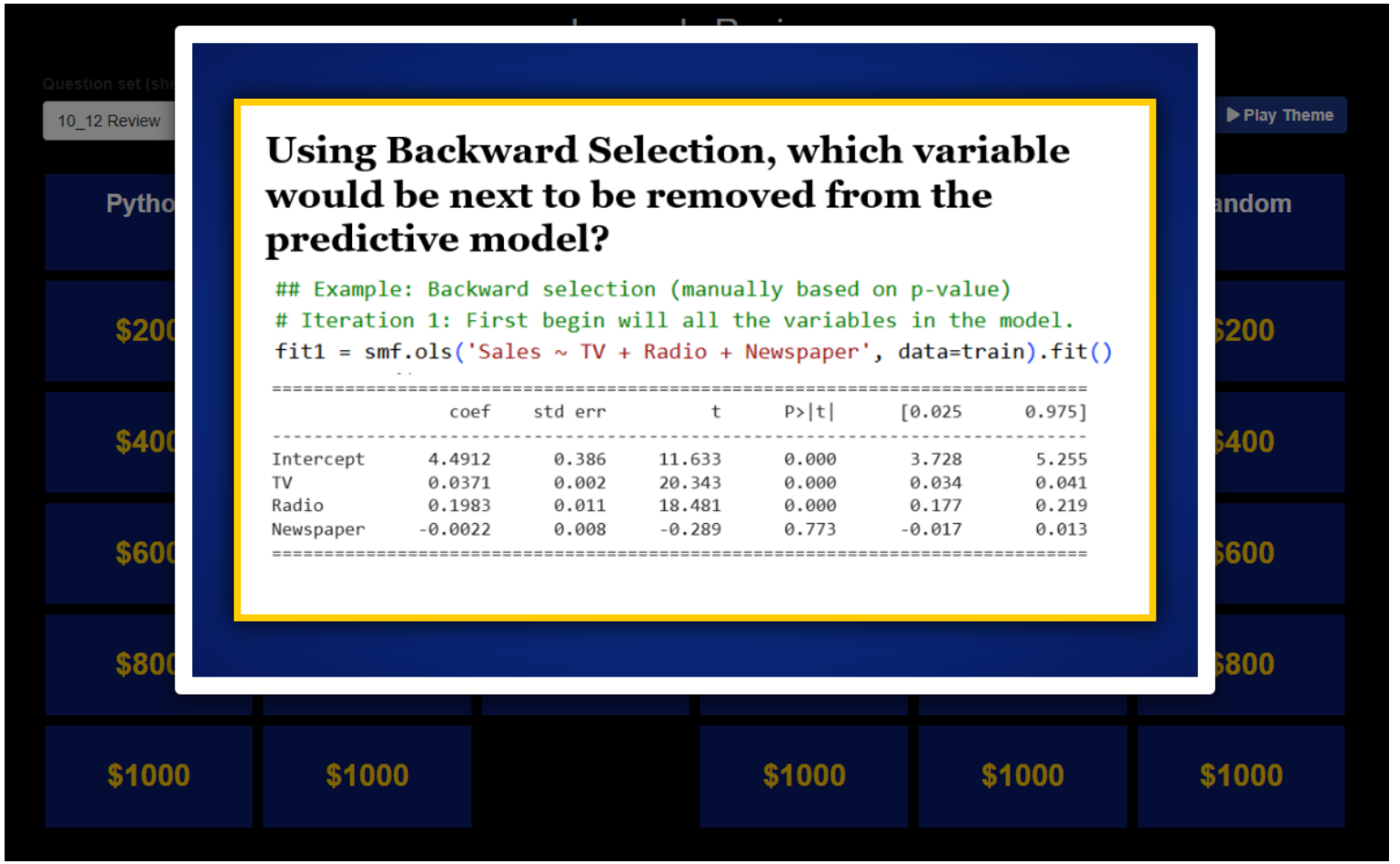


Figure 7: Questions shown as an image

Jeopardy game board

- Figure 8 provides another example which was sourced from the course lecture slides.
- In this example we are displaying an image previously discussed in class from James, Witten et al. (2013) on the relationship between model flexibility and overfitting.

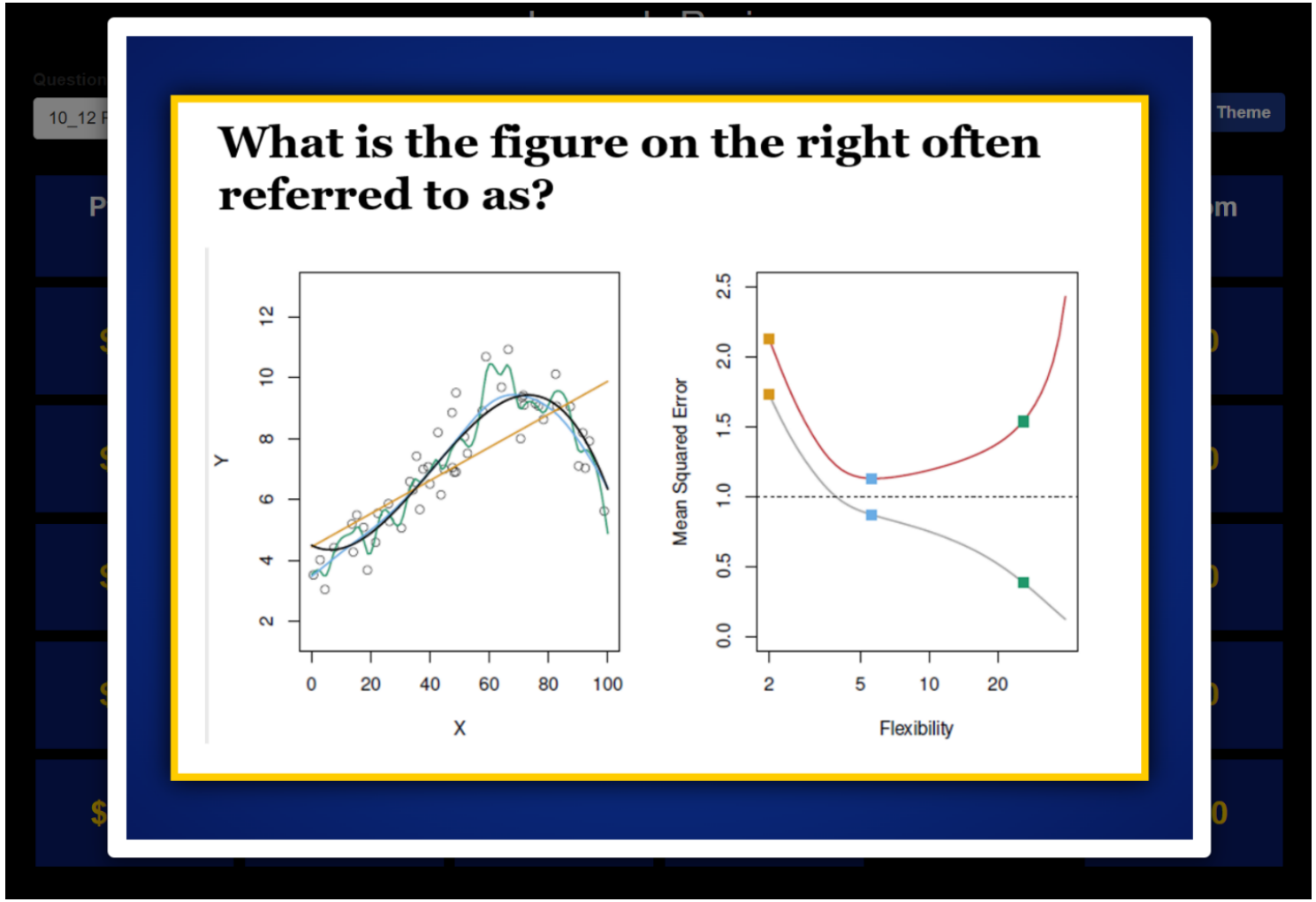


Figure 8: Use an image from textbook or lecture slides

‘Daily Double’ feature

- The last feature for our app is the Daily Double, which is an exciting event in the actual Jeopardy game.
- Whoever selects the cell which has the hidden Daily Double gets time to discuss with their team how many of their accumulated points they would like to wager.
- So, if a team has $2600 in total points at that time, they could wager up to $2600.

Category	Value	Question	Answers (optional)	Daily Double
Text Mining	1000	Identifies and label	Named Entity Reco	
Statistical Metrics	200	Summarizes the pr	Overall accuracy	
Statistical Metrics	400	Summarizes classi	AUC/ROC	
Statistical Metrics	600	Gives a balanced c	Matthews correlati	
Statistical Metrics	800	Quantifies how mu	Lift	1
Statistical Metrics	1000	Measures the shar	Sensitivity	

Figure 9: Daily Double column is where you indicate where to have a Daily Double alert

The instructor can make this feature appear at any category-value cell that they choose by indicating that in the Daily Double column found in the questions.xlsx spreadsheet with a value of 1 as shown in Figure 9.

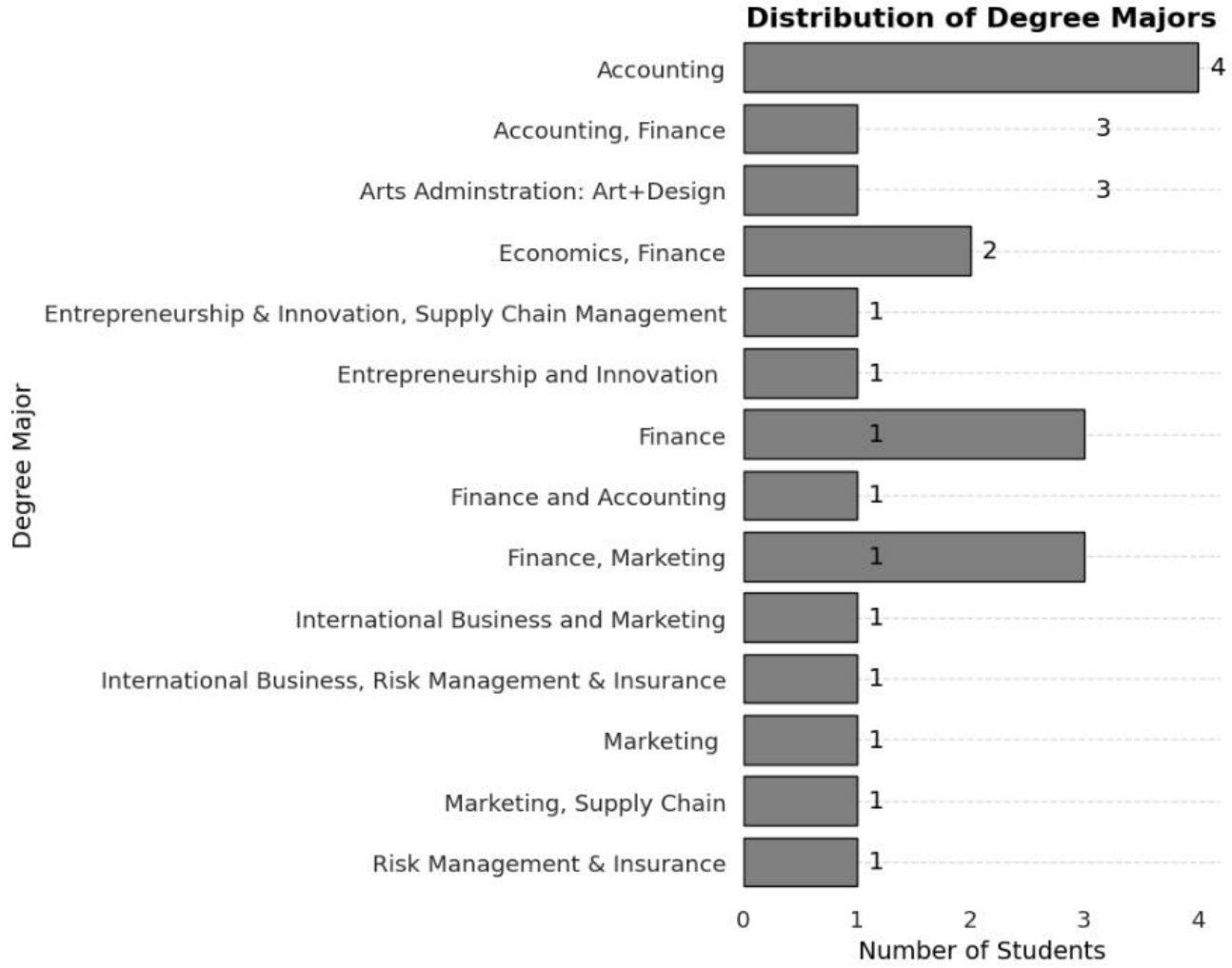
‘Daily Double’ feature

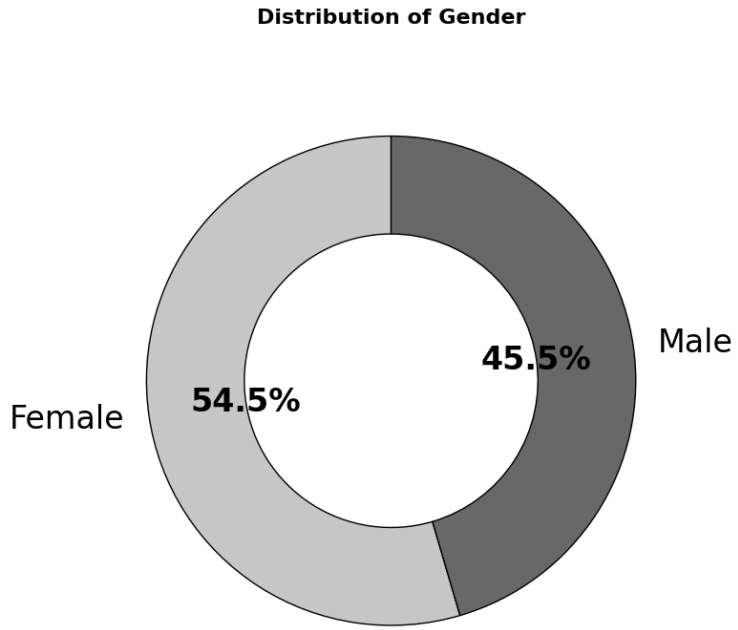
- When that category-value combination is selected during the game, the Daily Double image will appear with the sound alert just like in the real game as shown in Figure 10.
- The alert image will remain on the gameboard until you click again anywhere on the interface. This gives you time to discuss with the team the amount they want to wager about the upcoming question.
- Once decided and clicked, the question will appear.

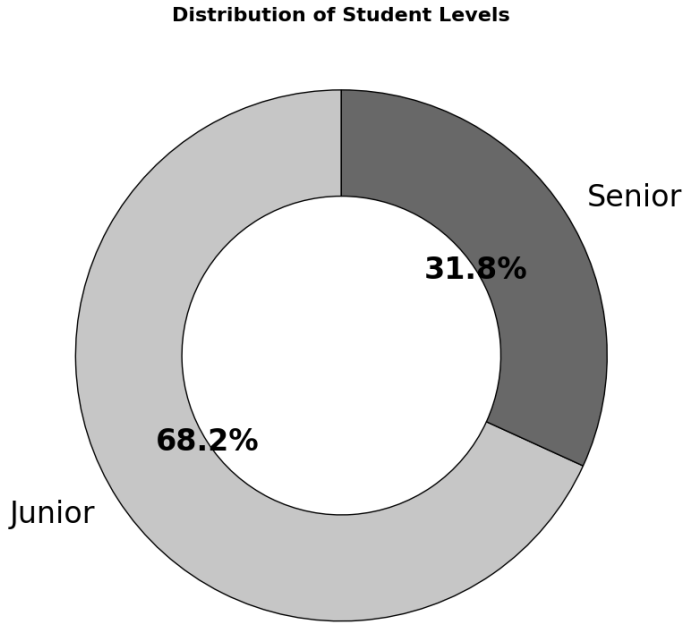
Figure 10: Daily Double alert then question showing on gameboard when ready

Study demographics

- All majors were represented in our two class sections except BTA. Many students double-major.

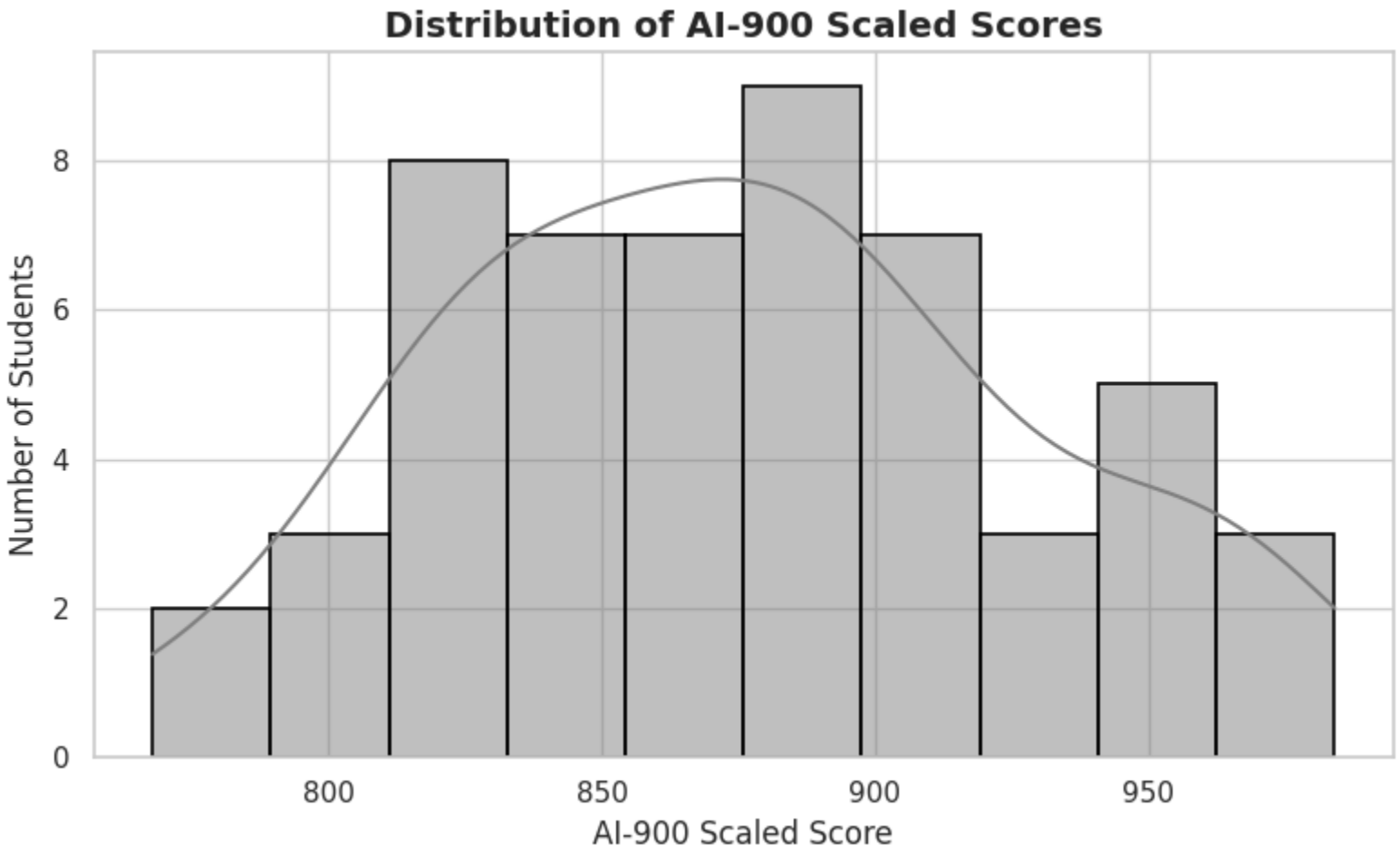






Student outcomes

- 94% of students passed the Microsoft AI-900 certification.



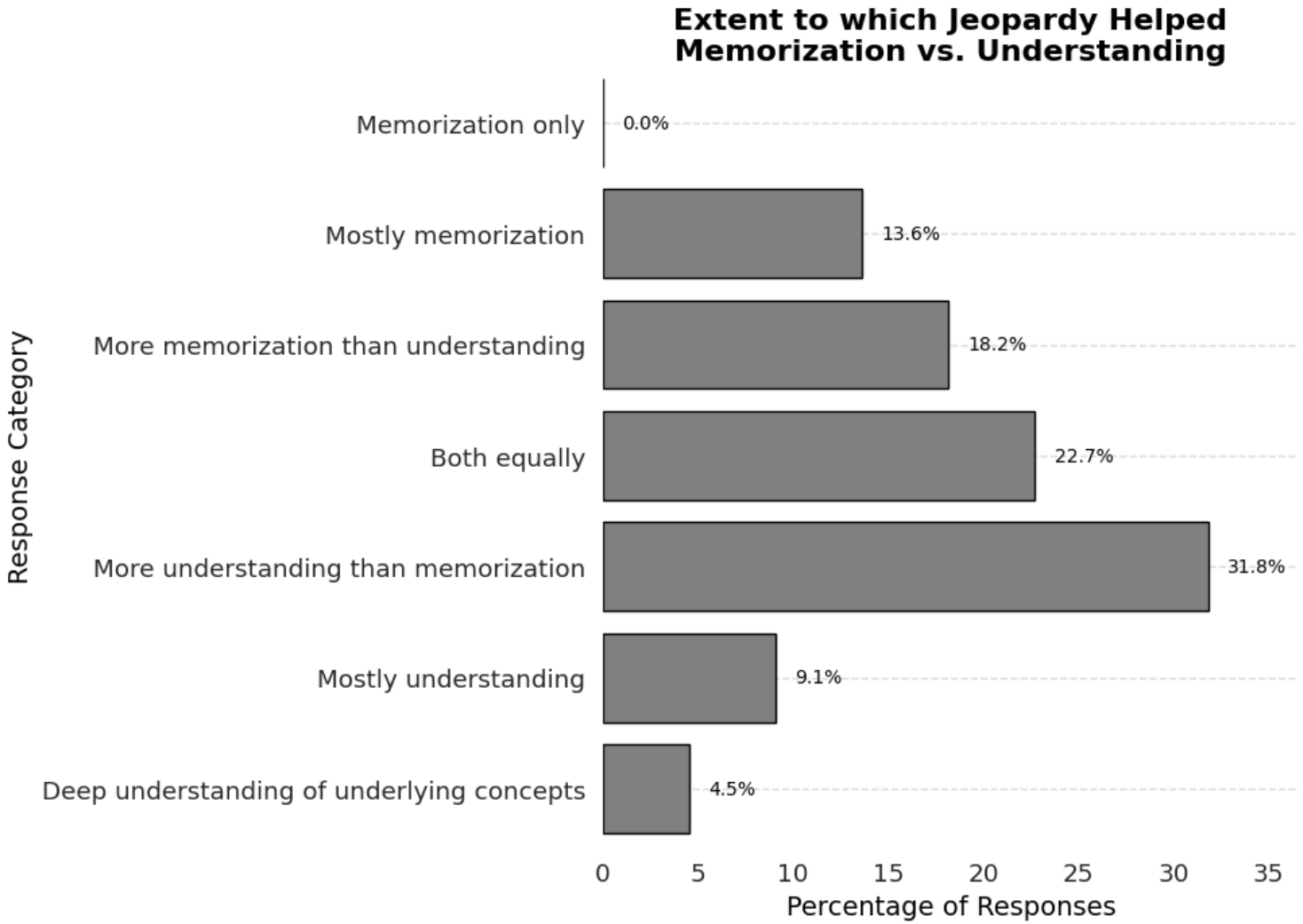
Student Feedback

- Student perceptions were mostly positive.

	Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree
The Jeopardy questions required me to reason about why an answer was correct, not just recall a fact.	0	9.09	9.09	9.09	40.91	31.82	0
Compared to typical reviews, this format improved my ability to decide which method or diagnostic to use in a new situation.	0	4.55	4.55	9.09	27.27	45.45	9.09
In the in-class Jeopardy sessions, I could perform well by memorizing terms and definitions without understanding when or why to apply them.	0	9.09	13.64	18.18	31.82	18.18	9.09
On the unit exam(s), I could earn a high score by memorizing terms and concepts without understanding when or why to apply them.	0	4.55	18.18	22.73	36.36	13.64	4.55
My team encouraged everyone to contribute during Jeopardy.	4.55	0	13.64	22.73	18.18	31.82	9.09
The buzzer-style competition made me less willing to speak up.	18.18	40.91	22.73	9.09	9.09	0	0
Jeopardy prompts, including images of output, helped me connect our Python work to course concepts.	0	0	4.55	13.64	22.73	45.45	13.64
Image-based questions (e.g., regression output) led to deeper discussion than text-only questions.	0	4.55	0	31.82	4.55	54.55	4.55

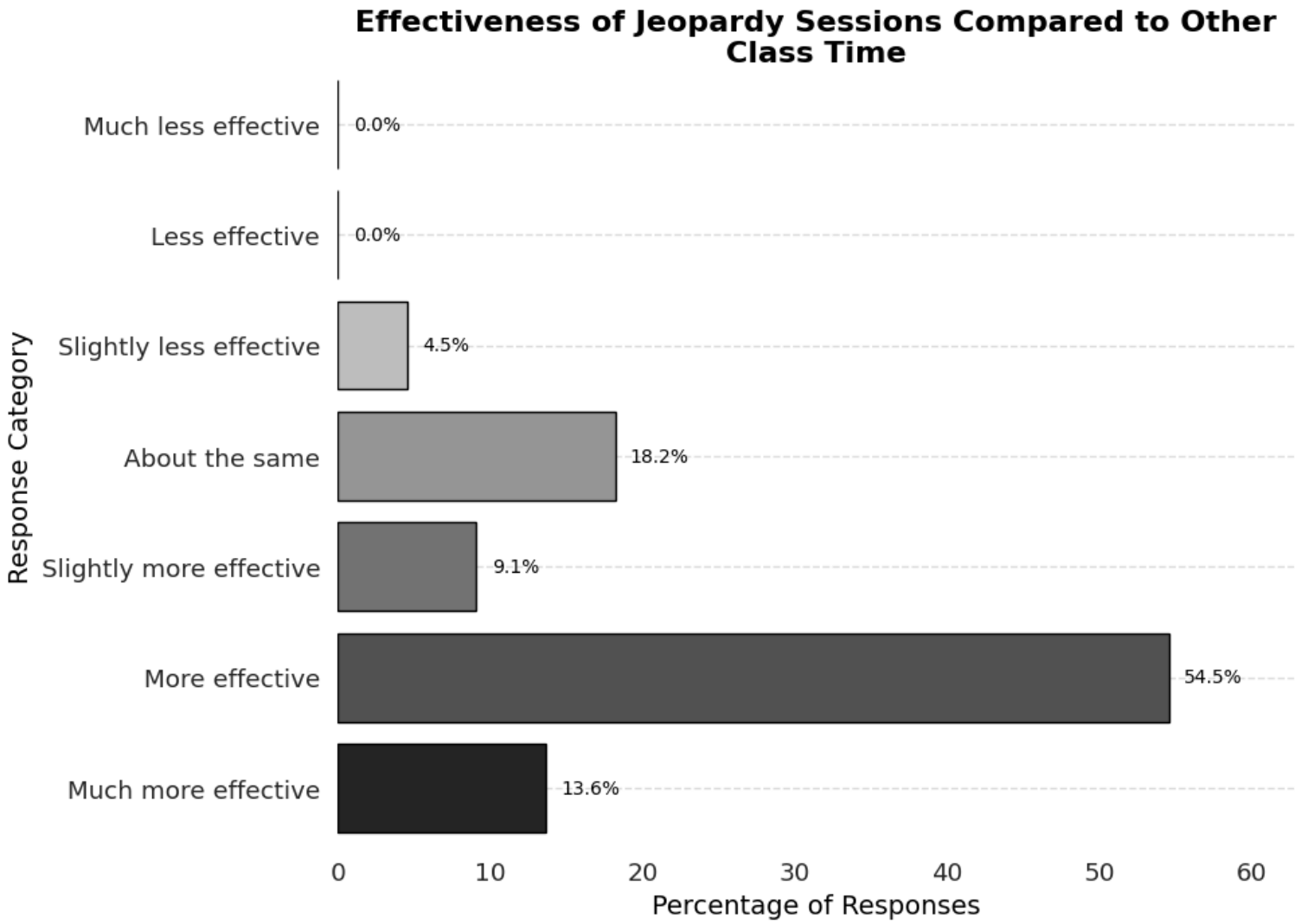
Student Feedback

- More than two-thirds believed is helped with understanding, while a third found it only help them memorize concepts.



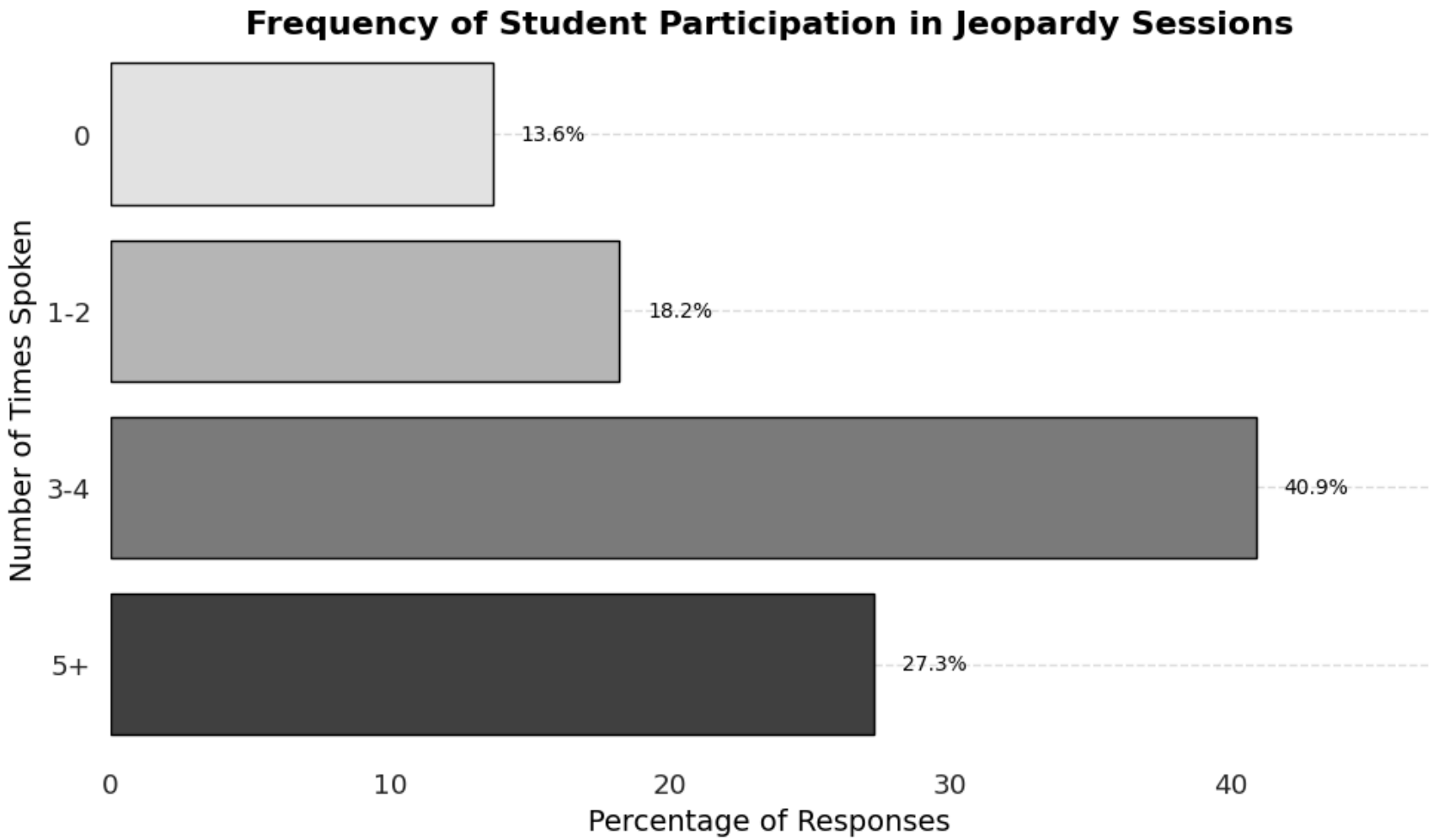
Student Feedback

- About four in five found the Jeopardy sessions to be more effective class time used



Student Feedback

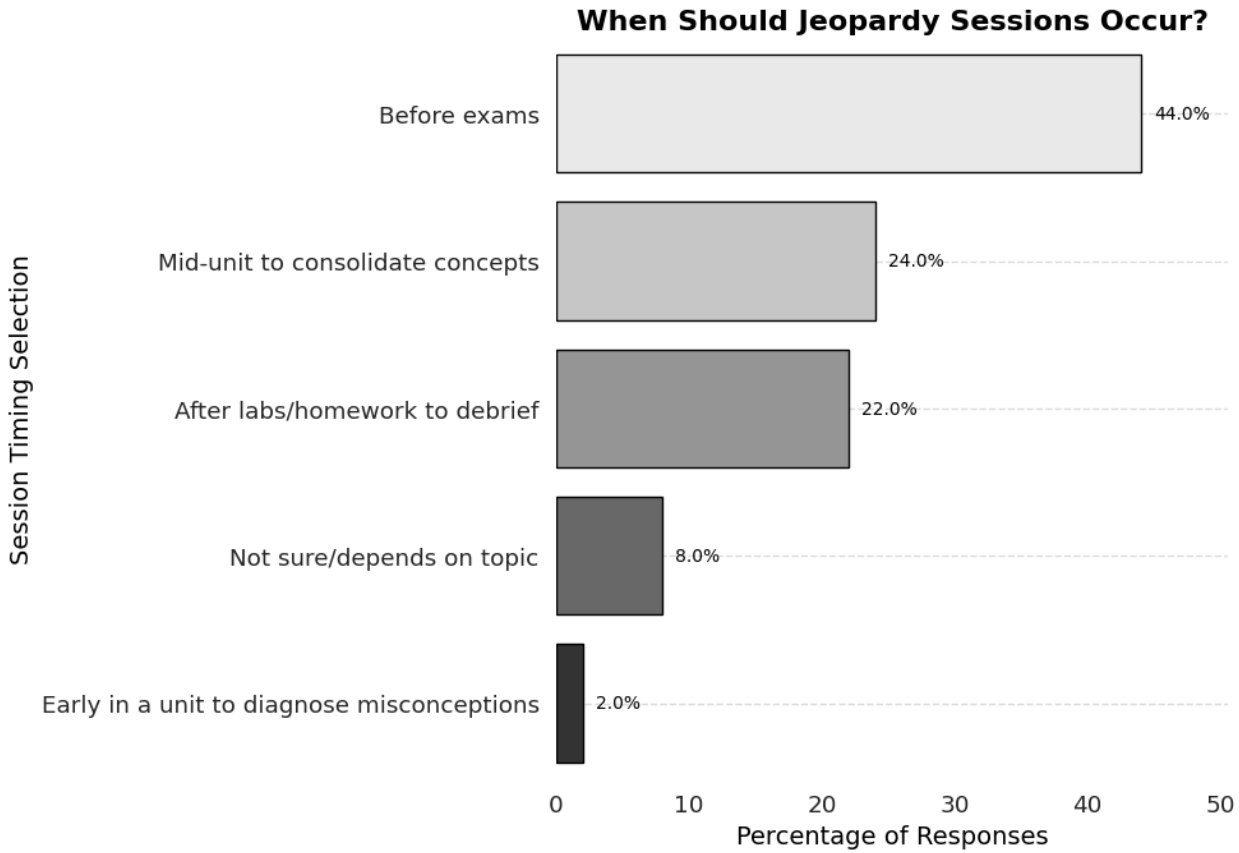
- Most students participated in answers a question or during the discussion of a question.



Student Feedback

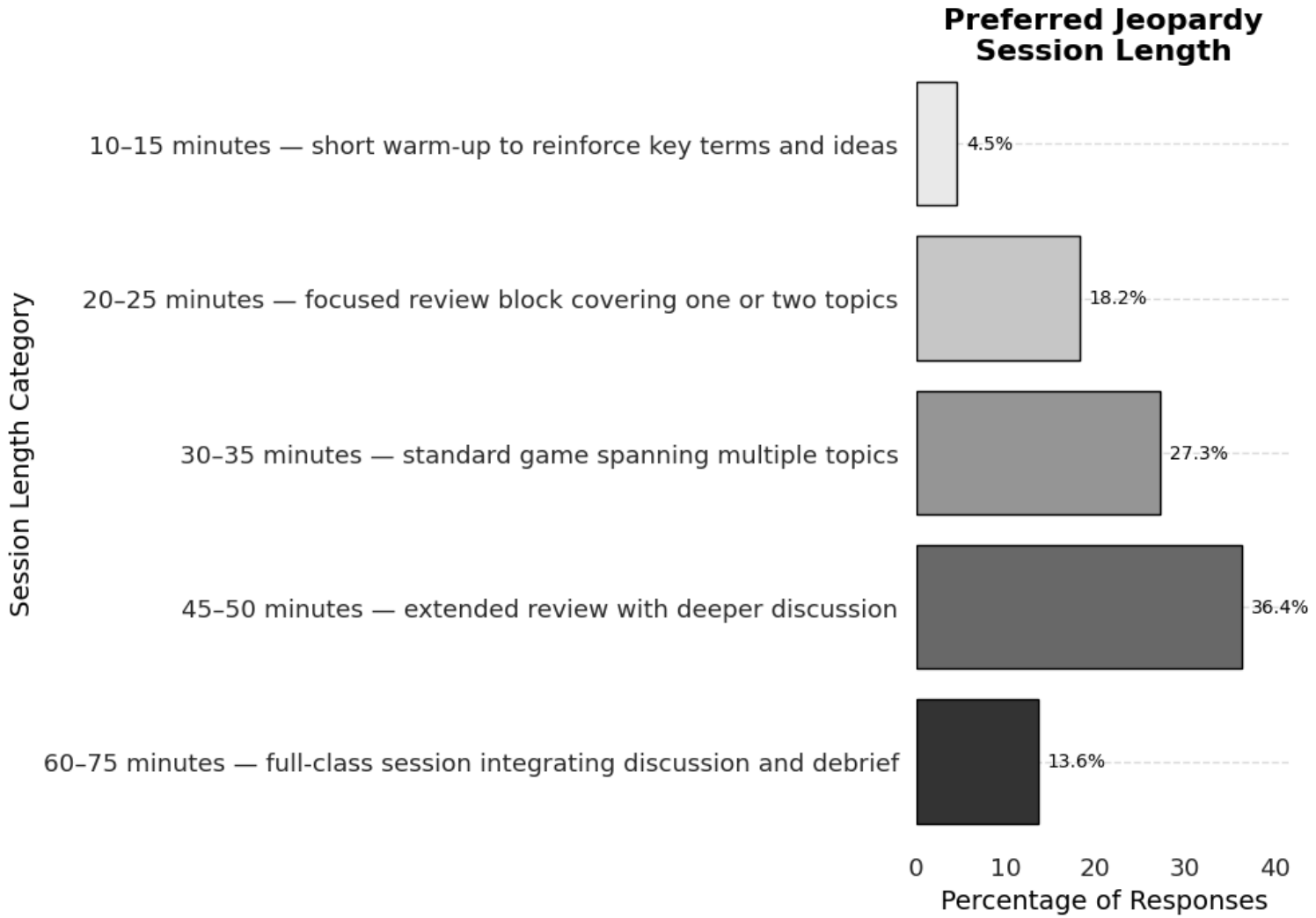
- Most students thought playing Jeopardy a few times a semester was ideal.
- About half suggested to play it before exams, but others found it could be useful to review assignments or at mid-semester.

	0	1	2	3	4	5+
Across this semester, how many Jeopardy sessions would be optimal to improve topic recall?	0	0	18.18	63.64	13.64	4.55
Across this semester, how many Jeopardy sessions would be optimal to deepen conceptual understanding?	0	0	18.18	59.09	18.18	4.55



Student Feedback

- Most students thought 30 to 50 minutes would be ideal for the Jeopardy session and it wouldn't need to be for the full class session.



Conclusions

- For non-BTA majors in required business-analytics course, instructors leveraging a discussion-centric Jeopardy implementation can help improve perceived understanding rather than just rapid recall memorization of topics. This aligns with (Gagnon 2012).
- To addresses measurement limitations flagged in single-session, survey-only implementations (Bayer-Hummel 2010), our perception data (conceptual clarity, discussion quality) seems to align with exam scores from a standardized certification exam that is not instructor-biased.
- We see
  - (i) Jeopardy reliably energizes participation and provides a non-threatening context for students to “try out” answers
  - (ii) achievement effects depend on context, question design, and facilitation
  - (iii) the strongest pedagogical value appears when gameplay is used to elicit reasoning and instructor-guided consolidation, not merely to reward retrieval speed.
- The Shiny gameboard (in R and Python) and spreadsheet-driven items make replication straightforward for instructors who wish to pilot similar sessions without heavy tooling.

Appendix - Literature Review

Study & context	Design / sample	Mechanics	Outcomes	Limitations / notes
(Revere, 2004)	Team-based			
Nursing, medical–surgical review (Bayer-Hummel, 2010)	30 game vs 25 traditional; single session; survey + aggregate grades	Teams; PPT board; shouted/raised-hand responses	96% motivated; 90% enjoyed; perceived learning ↑; mixed grade evidence	Convenience sample; 1 session; instructor survey; called for better measurement
Engineering, Mechanics of Materials (Gagnon, 2012)	Multi-chapter "reverse Jeopardy"; student survey; informal grade comparisons	Chapter boards; peer teaching stressed	Students reported better understanding; later-semester averages ↑ (72%→82–84%)	Non-experimental; early stage; time trade-offs noted
Construction classes (Leathem & Tatum, 2012)	Pilot; course surveys	Team play; push-button/lockout buzzers	High engagement/attention to play	Mainly qualitative; urged quantitative outcomes
Business/IS classroom (Simkin, 2013)	Eight trials; repeated-item testing + in-class survey; individual (non-team based)	Customized Jeopardy; manual scoring	No significant test gains; strong enthusiasm; diagnostic feedback to instructor	Recall-level item risk; calls for more empirical work
Community-college biology (Pathiraja et al., 2024)	One-group pre/post + pooled-exam comparison; N=55 across 4 courses	Team Jeopardy; PPT template; 45–60 min	Significant quiz and pooled-exam improvements; engagement/confidence gains	Quasi-experimental; effects vary by course/content
This study (Predictive Analytics core, all business majors; small private university)	Two sections (~58 students); randomized 6 table-teams (4–5 each); two Jeopardy days; post-hoc survey and between-section contrasts	Physical lock-out buzzers; instructor adjudication; discussion-centric rule (all answers seed dialogue)	Hypothesized ↑ engagement, discussion quality, and exam preparedness; analyze discourse and section performance	Novelty: business-school predictive-analytics context; hardware buzzers; all questions-answers→discussion pedagogy; dual-section design

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