

## INTRODUCTION

While teaching a final quarter MS in Business Analytics course, I wondered **Are MSBA students achieving basic skills in modeling and coding before graduation?**

I explored the literature and found some articles that touched on parts of my question – for example I found articles about

- How to teach programming to business students (e.g., to Finance Students) [1]
- How to make sure technical students have basic mathematical knowledge [2]

But while the course I am teaching briefly discusses these topics, it is "assumed" that they already know this material. I decided to create some modeling and coding quizzes in the course to assess these skills.

My expected results based on previous quarter observation:

- **Top performing and low performing students don't advance in skills throughout the course at the same rate.**
- **Encouraging REV UP activities with bonus points** will increase the proportion who engage with this material and **the class will score better on the quizzes.**
- **Providing customized feedback will improve the quiz scores.**

## MATERIALS & METHODS

- Participants:**
- 17 students in the Summer 22 course
  - 20 students in the Winter 23 course
  - 24 students in the Winter 24 course

**Materials:** The materials for the class are the original course materials adding in 3 coding and 3 modeling quizzes (of increasing difficulty) throughout the quarter and a self-report of their confidence with these skills at the end of the quarter.

**Procedures & Design:** For this study, I have grouped the class into the following comparisons. Note the interventions were cumulative.

**Topic:** Coding vs Modeling Concepts

**Difficulty:** Lower to Higher difficulty 1, 2, 3

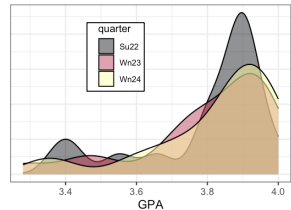
**Class Rank:** High, Middle, Low Class Rank where 1= highest grade in course

Summer 22: 5H, 7M, 5L; Winter 23: 6H, 8M, 6L; Winter 24: 8H, 8M, 8L

**Intervention Bonus:** Win 23 and 24 added bonus points on REV UP questions to reinforce and challenge students including some focused content covered in the quizzes. Even if they don't submit the REV UP questions, they get the answers after they submit their classwork for the day.

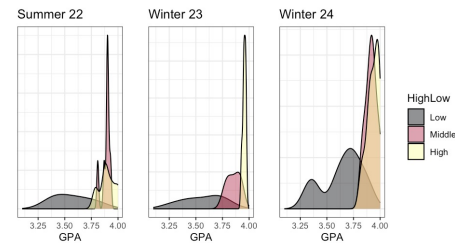
**Intervention Feedback:** Win 24 provided personalized feedback for incorrect answers.

All Students



Overall, GPAs were similar across quarters (Medians 3.88, 3.86, 3.89).

**Class Rank Varied**  
Across high, middle, and low ranks, we can see in winter 23 there was less variability in GPAs for middle and high. The summer showed bimodal distributions for middle and high class ranks. Winter 24 showed a bimodal distribution for low and overlapping high and middle ranks



Note: These density graphs are similar to histograms and show the distribution of values

## RESULTS

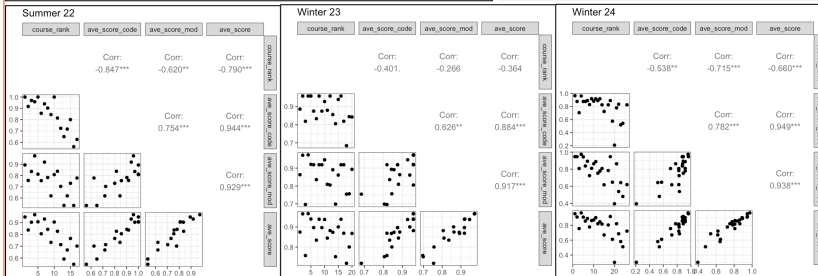
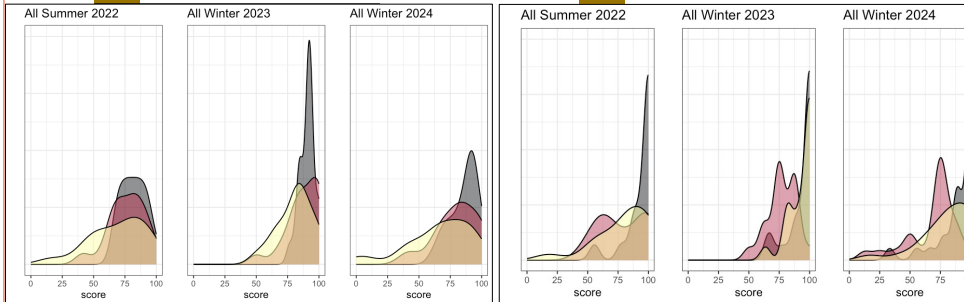
For the modeling quizzes, the scores were more variable in the summer. The scores were also higher in the winter quarters. For the coding quizzes the scores were more variable than the modeling quizzes, but we still see an improvement in the final coding quiz in the winter 23 quarter. For winter 24, we see mixed results.

### Modeling Quizzes

	Median	Modeling 1	Modeling 2	Modeling 3	Quiz
Sum 22	85	75	75	75	Mod1
Win 23	92	92	83	83	Mod2
Win 24	92	83	67	67	Mod3

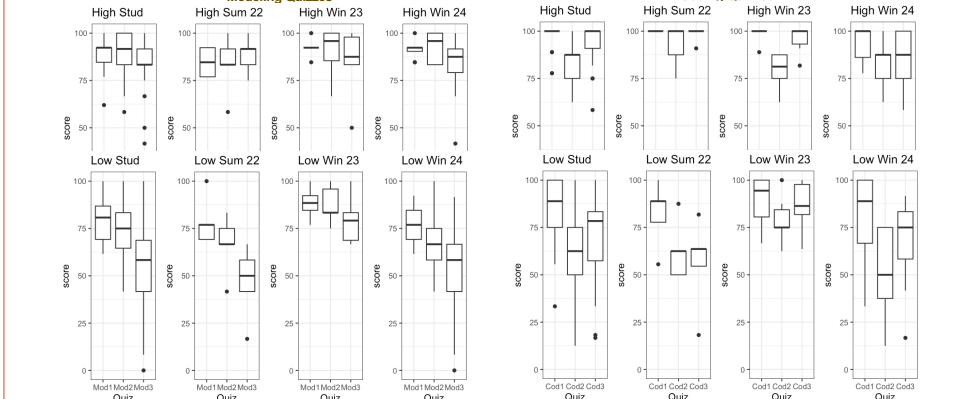
### Coding Quizzes

	Median	Coding 1	Coding 2	Coding 3	Quiz
Sum 22	100	75	82	82	Cod1
Win 23	100	75	100	100	Cod2
Win 24	100	75	83	83	Cod3



### Comparing High and Low Class Rank Students

While both summer and winter 23 saw a decrease in quiz scores as they got harder for low course rank students, the results were less extreme in the winter 23. Overall the high rank students had less change and low ranked students showed a decrease for harder modeling quizzes and a biggest decrease in coding 2 quiz. A Wilcoxon rank sum test on the medians showed in summer there were differences between high and low students (Modeling p-value .016, Coding p-value .012) and in winter 24 (Modeling p-value .013, Coding p-value .016), but in winter 23 there were no differences in medians (Modeling p-value .227, Coding p-value .221). Overall middle was similar to high for coding and low for modeling (not shown).



We can also compare student course ranks (lower means better course grade) with their average scores (3 coding, 3 modeling, overall).

We can see that in the summer quarter their scores were more correlated with their course rank. In the winter 23 the scores did not drop as low and for winter 24 the scores were flatter except 1 student.

## YOU CAN PARTICIPATE



<https://bit.ly/KKPresentationFiles>

Digital copy of this poster  
Padlet to answer the Question below:

How do you provide "differentiated instruction" for students at different levels in your course with the hope that everyone gains?

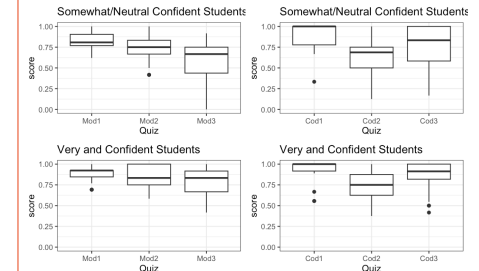
## CONCLUSIONS

We did see the expected result that the students who were performing the lowest in the course had larger decreasing scores on the coding and modeling quizzes as they got harder. This was more pronounced for the modeling quizzes. We also showed that adding just a few REV UP questions (challenging problems and/or "basic skill" coding/modeling questions) to each set of classwork problems (REWIND problems designed to practice material from class lecture) for bonus points may have caused higher scores on subsequent quizzes for winter 23 but not as much for winter 24. Student total bonus points was somewhat correlated with with average scores (winter 23: code 0.34, modeling 0.39; winter 24: code 0.21, modeling 0.47.) No other substantive changes were made to the course.

We can see from the median scores that overall the scores did increase from the Summer to the two Winter courses but that the feedback intervention for Winter 24 did not show an increase over just the REV UP bonus points.

	Modeling				Coding			
	Su22	Win23	Win24	Win	Su22	Win23	Win24	Win
1,2,3 Average	62	88	64	76	65	84	78	81
Low	62	88	64	76	65	84	78	81
Middle	78	86	81	84	86	88	89	89
High	84	92	92	92	97	92	88	90
ALL	78	89	81	85	86	88	85	97

Finally, we can see that students who rated themselves as very confident and confident did perform better than those that said they were somewhat confident or neutral about their respective modeling or coding skills.



## FUTURE DIRECTIONS

Future analysis will explore the quiz question topics that the students repeatedly struggled with to see if the course materials should be updated. In addition, the professor created the coding and modeling quizzes based on personal thoughts about the "basic skills" that all students should know about modeling and coding. Additional consultation with additional faculty should occur.

## REFERENCES

- [1] Yan, Y (2017) Teaching Programming Skills to Finance Students: How to Design and Teach a Great Course, *Financial Innovation*, 3(1)
- [2] Pugacheva, et al. (2020) Forming the Basic Mathematical Knowledge Among Technical Students, *International Journal of Emerging Technologies in Learning (IJET)*, 15(3)