Assessing MSBA Students' Coding and Modeling Skills

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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.**
- **Providing REV UP activities with bonus points** will increase the proportion who engage with this material and **the class will score better on the quizzes**.

MATERIALS & METHODS

Participants:

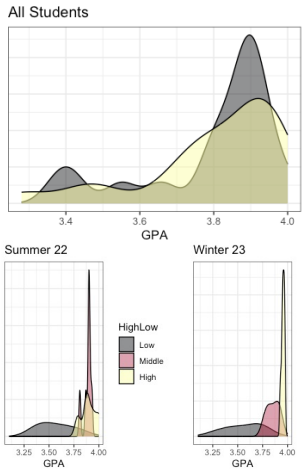
- 17 students in the Summer 22 course
- 20 students in the Winter 23 course

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. An **intervention in the Winter was including REV UP questions for bonus points to reinforce and challenge students including some focused content covered in the quizzes.** Even if they don't submit the REV UP questions, they will get the answers after they submit their classwork for the day.

Procedures & Design: For this study, I have grouped the class into the following comparisons.

	Su22 Class taught w/o REV UP points	Wn23 Class taught with REV UP points
Coding Concepts (Lower to Higher difficulty 1, 2, 3)	x	x
Modeling Concepts (Lower to Higher difficulty 1, 2, 3)	x	x

Additional Analysis across the Groups:
High, Middle, Low Class Rank where 1= highest grade in course



Across the 2 quarters we can see their GPAs varied more in the second quarter (Win23) but **overall, the GPAs were similar** (Medians 3.86 vs 3.88).

Class Rank
High, Middle, Low

Su22:
- High (top 5)
- Middle 7
- Low (lowest 5)

Wn23:
- High (top 6)
- Middle 8
- Low (lowest 6)

Across high, middle, and low ranks, we can see that in the winter there was less variability in GPAs for middle and high. The summer showed bimodal distributions for middle and high class ranks.

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

RESULTS

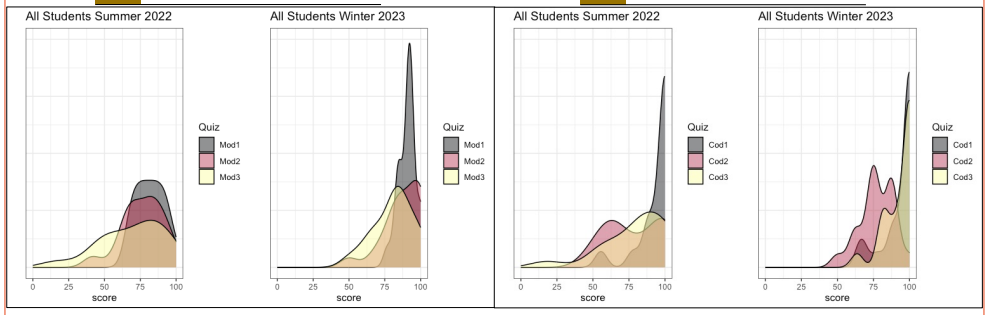
For the modeling quizzes, the **scores were more variable in the summer**. The scores were also higher in the winter quarter. For the coding quizzes the scores were more variable than the modeling quizzes, but we still **see an improvement in the final coding quiz in the winter quarter**.

Modeling Quizzes

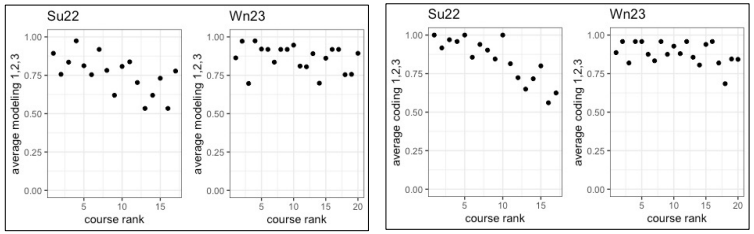
Median	Modeling 1	Modeling 2	Modeling 3
Sum 22	85	75	75
Win 23	92	92	83

Coding Quizzes

Median	Coding 1	Coding 2	Coding 3
Sum 22	100	75	82
Win 23	100	75	100



Modeling Quizzes | **Coding Quizzes**



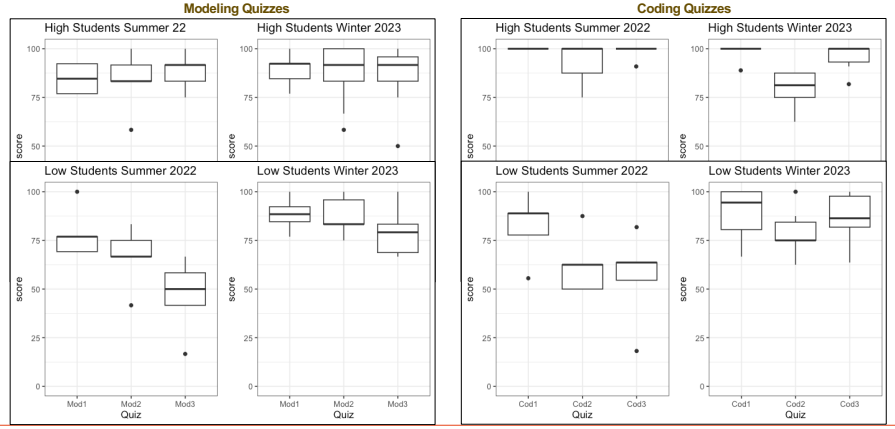
We can also compare student course ranks (lower means better course grade) with their average scores across the 3 coding and 3 modeling quizzes.

We can see that in the **Summer Quarter their scores were more correlated with their course rank**. In the Winter, the scores did not drop as low for both modeling and coding quizzes.

Comparing High and Low Class Rank Students

While both summer and winter saw a decrease in quiz scores as they got harder for low course rank students, the results were less extreme in the winter. In addition, the high rank students' quizzes did not show as much change. But more did struggle with the second coding quiz in Winter. 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) but in **Winter there were no differences in medians** (Modeling p-value .227, Coding p-value .221).

Modeling Quizzes | **Coding Quizzes**



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https://bit.ly/KKPresentationFiles

- Please use this QR Code or bit.ly link to access
  - Digital copy of this poster
  - Padlet to answer the Question below

https://padlet.com/kkeeling/SOTLKeelingOct23

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 decreasing scores on the coding and modeling quizzes as they got harder. We also showed that adding just a couple of REV UP questions (challenging problems and/or "basic skill" coding and 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 the subsequent quizzes. It is noted that the quizzes were not returned to the students in the Summer and questions missed were just discussed during the following class so the questions could not have "gotten out" to the Winter quarter students. 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 Winter course taught with REV UP bonus points.

SU 22 Medians	Ave Coding 1,2,3	Ave Modeling 1,2,3
Low	65	62
Middle	86	78
High	97	84
ALL	86	78

Wn23 Medians	Ave Coding 1,2,3	Ave Modeling 1,2,3
Low	84	88
Middle	88	86
High	92	92
ALL	88	89

FUTURE DIRECTIONS

Future analysis needs to match completion of REV UP questions that tie to specific questions on the quizzes to see if there was any correlation. The quiz question topics that the students repeatedly struggled with will also be examined to see if the course materials should be updated.

In addition, a future examination of their self-reported confidence with modeling and coding will be explored. It is noted that these classes had small sample sizes so additional exploration should be done to see if these few REV UP questions were the reason that the scores improved. 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)