



Precalculus Skills

Joseph Lo

CWSEI, Department of Mathematics

[Overview]

- Focus on pre- and post-diagnostic in a two-term differential calculus course, Math 110.
- A study on how different types of questions correlate with student performance (2010).
- Preliminary analysis on how much remedial exercises can improve students' precalculus skills (2011).

[Precalculus Diagnostic Test – Reasons and Purposes]

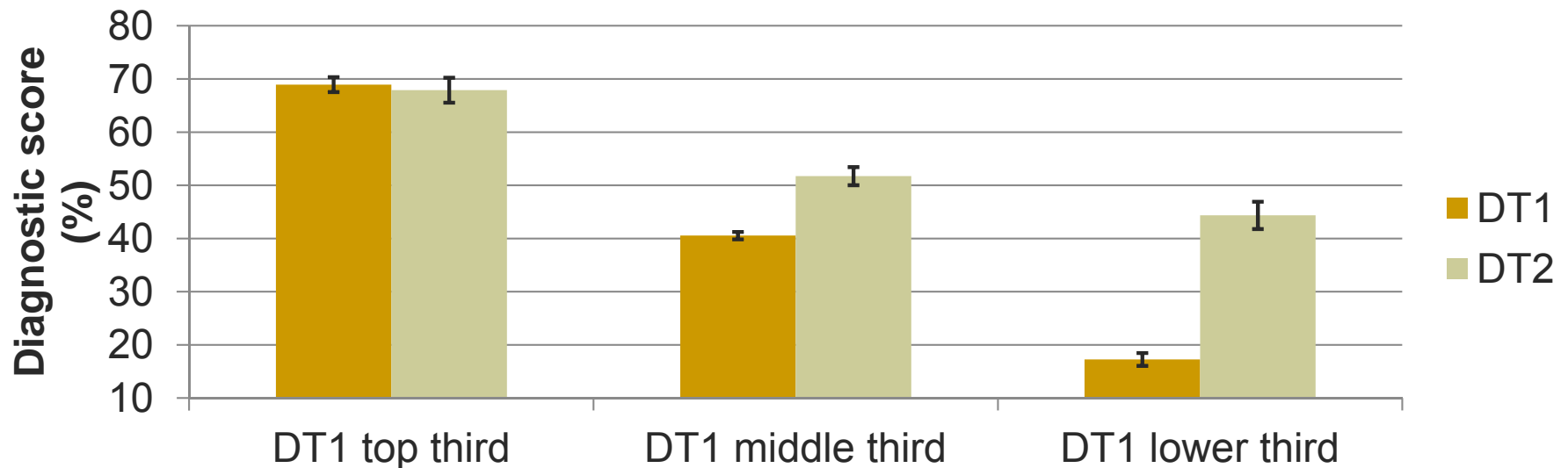
- The reason
 - Students with weak precalculus skills tend to struggle in the first calculus course.
- For students
 - Make them aware of their weaknesses in precalculus skills
 - If necessary, remedial exercises will be provided to strengthen their skills
- For us
 - To identify what precalculus skills are the most important for success in calculus
 - The analysis of common errors give us some insight in students' misconceptions.

[Precalculus Diagnostic Test]

- 16 multiple-choice questions, 50 minutes
 - 8 questions on algebra
 - 4 word problems
 - 4 other questions related to graphs, functions and geometry
- Given in September as a pre-diagnostic.
- The same diagnostic was given again in March as a post-diagnostic.

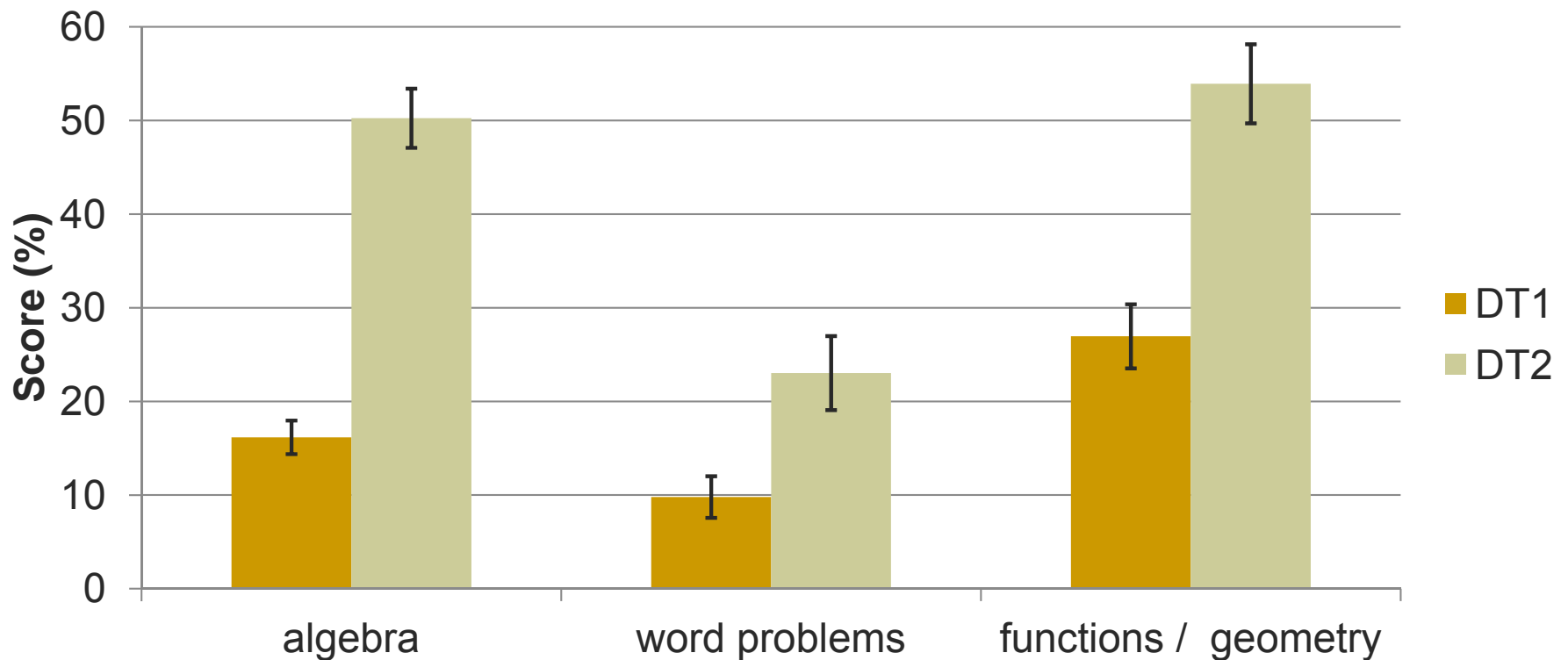
Pre-/post-diagnostic results

- Pre-diagnostic: DT1; Post-diagnostic: DT2
 - Top third: N = 66, DT1 > 50%
 - Middle third: N = 90, $31.25\% \leq \text{DT1} \leq 50\%$
 - Lower third: N = 51 DT1 < 31.25%
- Those with high scores in DT1 did not improve in DT2



[Pre-/post-diagnostic results]

- For those in the lower third in DT1, the largest improvement was on algebra questions.



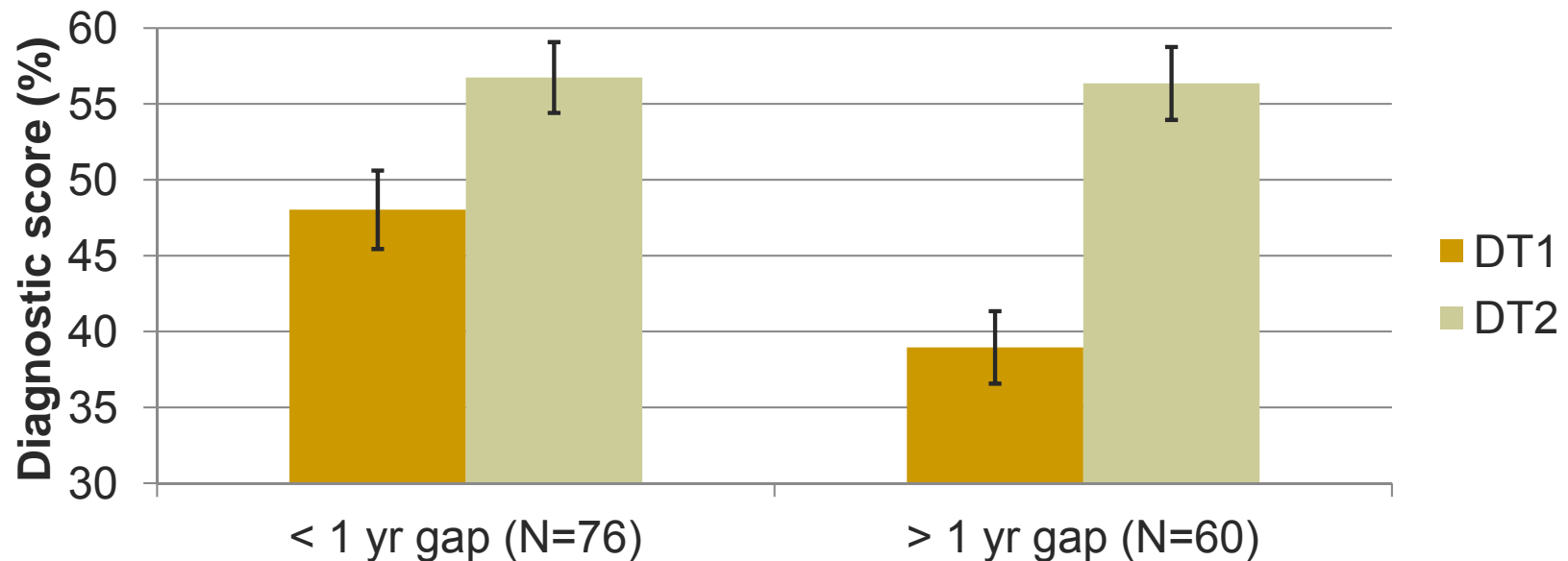
[Correlation with course grades]

- Correlation between DT1 and course grades decreases as the course proceeds.
- DT2 written in March correlates better with the final exam in April and the final grades.
- The correlation between DT1 and DT2 is $r = 0.52$.

r	Oct MT	Dec Exam	Feb MT	Apr Exam	Final Grade
DT1	0.52	0.42	0.32	0.28	0.35
DT2				0.42	0.50

[For those who did not take math for a long time...]

- Those who did not take math for more than 1 year before Math 110 did substantially worse than their peers in DT1
- However, they were able to catch up in DT2.

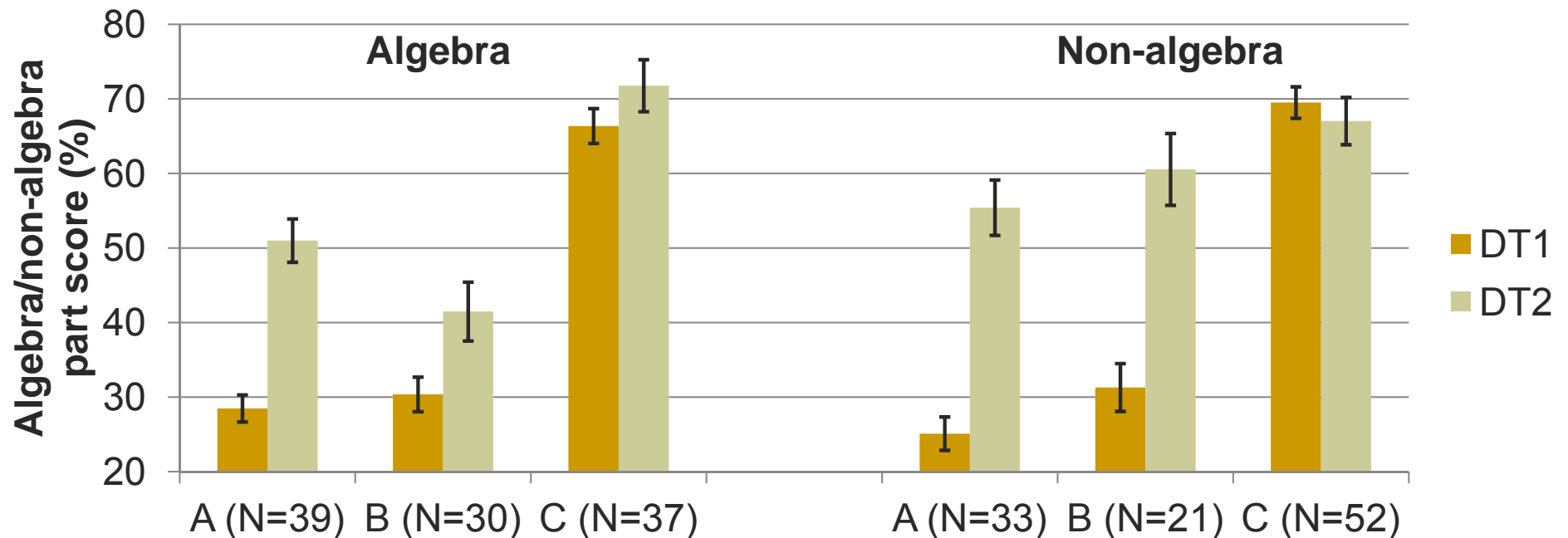


[Remedial exercises]

- Introduced in 2011
- Consist of two parts
 - Algebra
 - Non-algebra (functions, graphs, geometry, word problems)
- Assigned online “weekly”, from Week 6 in Term 1 to Week 10 in Term 2, a total of 14 sets.
- The algebra exercises are mandatory if students fails the algebra part of DT1.
- The non-algebra exercises are mandatory if students fail the non-algebra part of DT1.

Remedial exercises

- A: remedial exercises required and completed
- B: remedial exercises required but not completed
- C: remedial exercises not required



[Summary]

- Low-performing students in DT1 improved their skills through the course, but still not reaching the level of high-performing students.
- The gap in skills level between students who did not take math for more than 1 year and their peers closed after the course.
- Weekly remedial work improved algebra skills, but did not show an effect with non-algebra skills.

Precalculus Skills