



UiO • Faculty of Dentistry
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Multiple Choice as formative assessment in dental education



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Background-MCQ

- Focus on **maintaining previously attained knowledge among dental students**
- **Addressing the concern of students graduating without mastering fundamental knowledge**
- MCQ testing **aims to refresh and maintain knowledge**, but challenges include:
 - Potential for encouraging surface learning
 - Perceived by students as lacking productive feedback
- Implementation of MCQs aims to **provide feedback and allow students to refresh their knowledge productively**

Background-MCQ

- **Criterion-based test:** students must be able to master a certain level of knowledge
- **Intention:**
 - Ensure that students remember the fundamental knowledge through all semesters
 - Increase the fundamental knowledge
 - Ensure a **minimum level of knowledge** on the exam
 - **Acknowledge students with knowledge gaps** early
 - Make the **students aware** of their own **knowledge**
 - Add to a more **even learning process**
- **Challenges:**
 - How to avoid this being a supplementary exam?
 - How to help students learn from these MCQ tests?
 - How to ensure the quality and correct implementations?



Implementation of MCQ

- MCQ group (3 academics, 1 IT, 1 administrator, 1 education specialist)
 - (Håvard J Haugen, Thomas de Lange, Hans Jacob Rønold, Eva Fetscher, Janicke Lian Jensen, Sukdeep Skakar)
- Used Learning Management System, Classfronter
- **Design of MCQ**
 - Plausible Distractors
 - Relevance questions from student's learning objectives
 - Relatively similar degree of difficulty between subjects
 - Avoid negative questions
 - Clear instructions to students
 - Pass level 70%
- A pilot of all questionnaires per semester with older students

Distribution of questions per semester

	MCQ 5th sem.	MCQ 6th sem.	MCQ 7th sem.	MCQ 8th sem.	MCQ 9th sem.	MCQ 10th sem.
5th semester	30	5	5	2	2	2
6th semester		30	5	3	3	3
7th semester			30	10	5	5
8th semester			-	30	10	5
9th semester			-	-	30	10
10th semester			-	-	-	30
Total number	30	35	40	45	50	55

Progressively more questions each semester. Always questions from previous semester

Evaluation

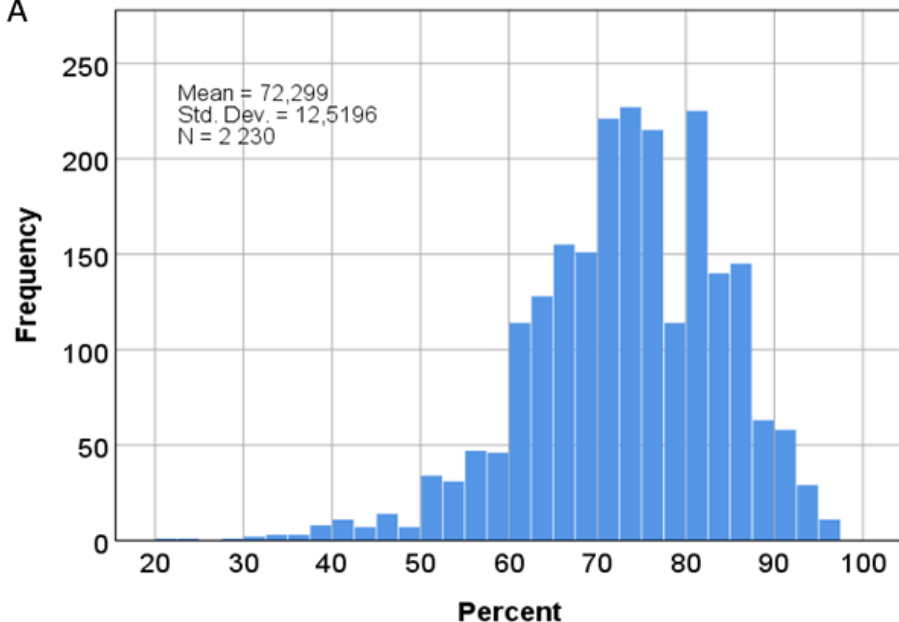
Questions:

- How to aid students in earlier exam preparation
- How to avoid this being a supplementary exam?
- How to help students learn from these MCQ tests?

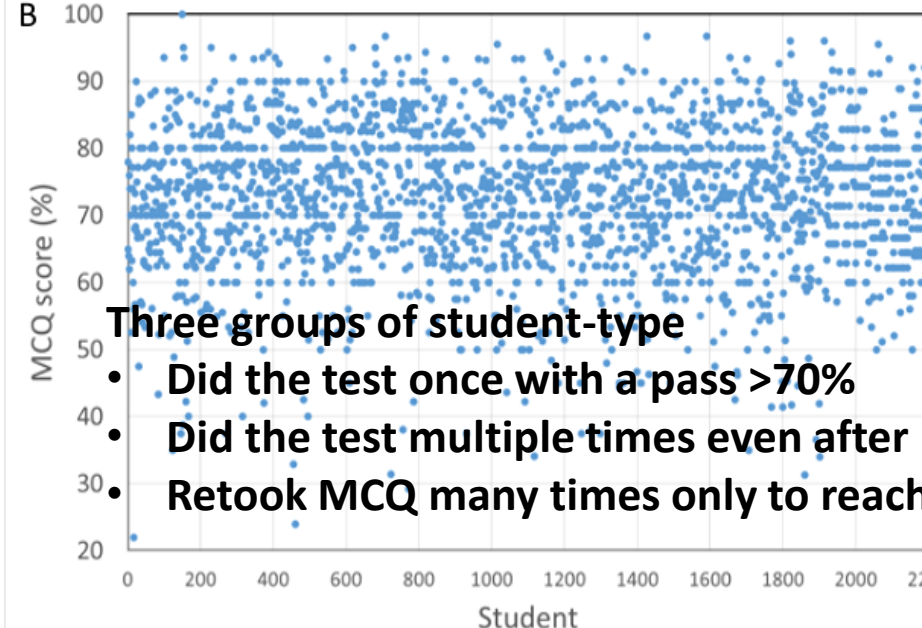
Method

- Tracked all student behaviour in MCQs in the period 2014-2019
- Linked to a questionnaire (Written consent). Approved by NSD
- Compiled database with >2200 unique student behaviours
- Descriptive and statistical analysis
 - Correlation
 - Mixed model regression analysis (least-square)

→adequate level of difficultness



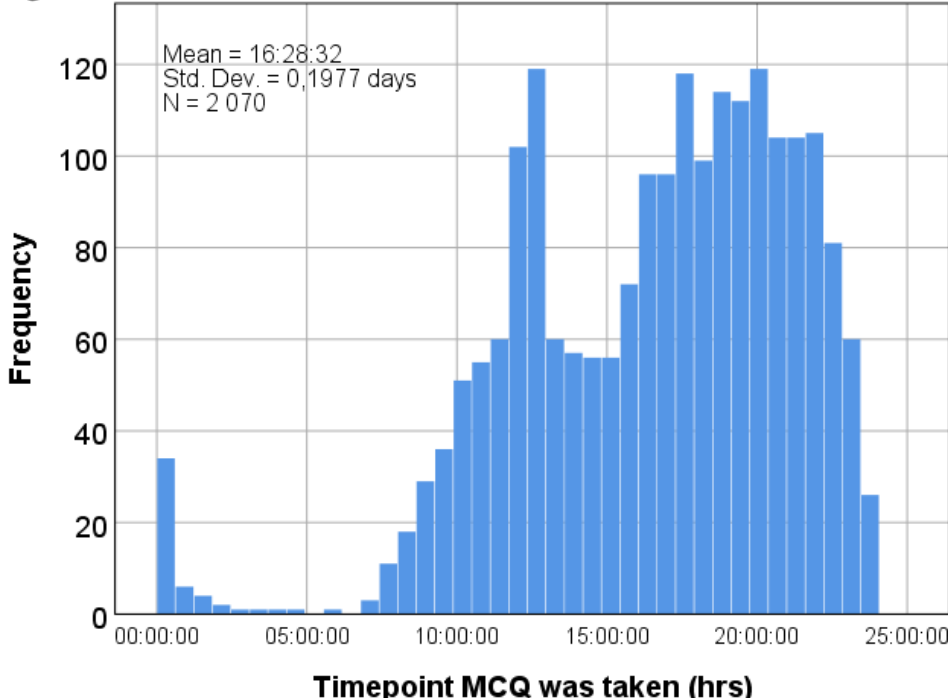
→most student retook MCQ even after obtaining 70%



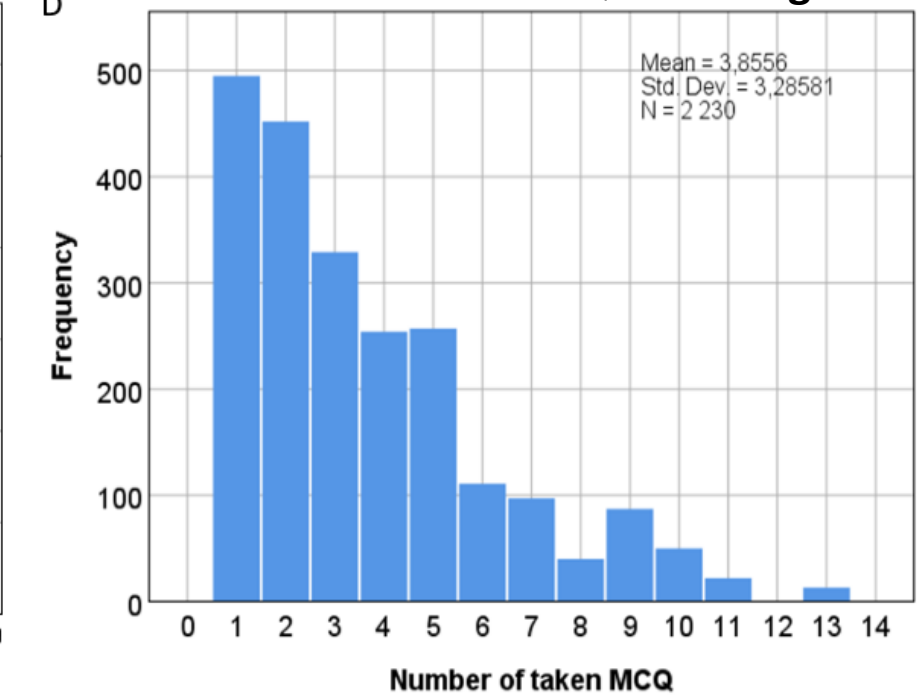
Three groups of student-type

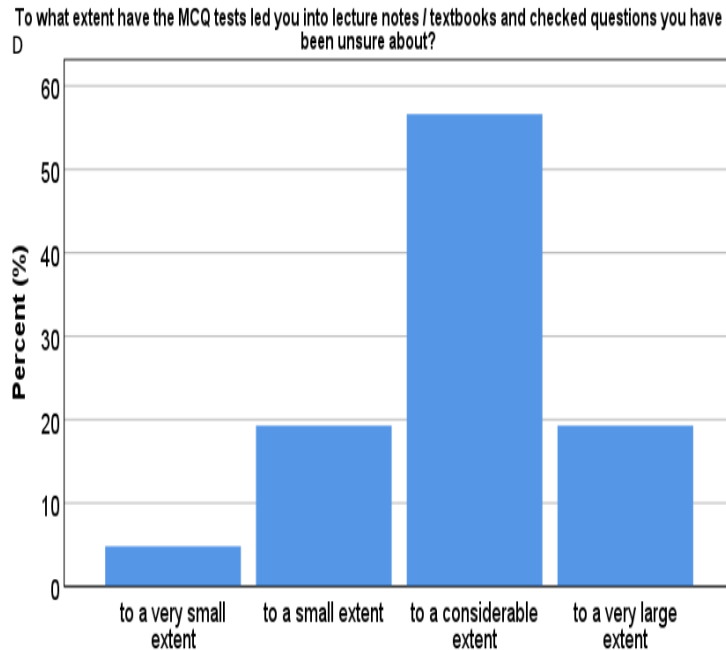
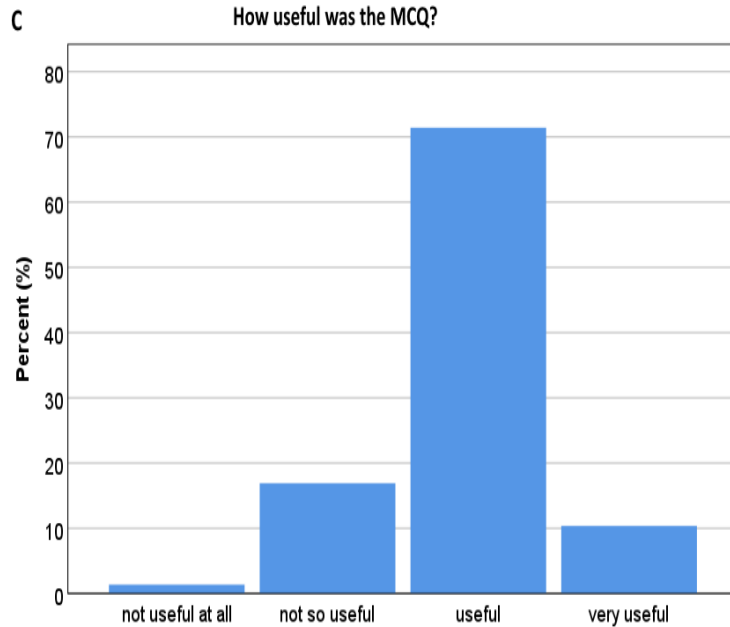
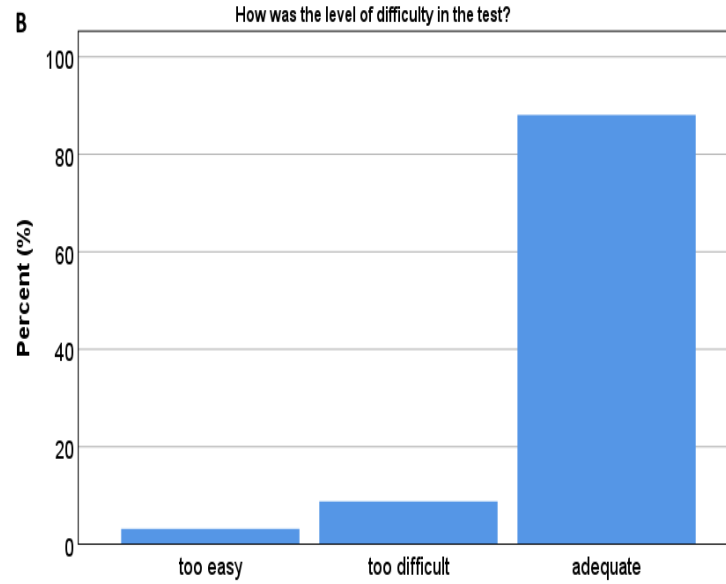
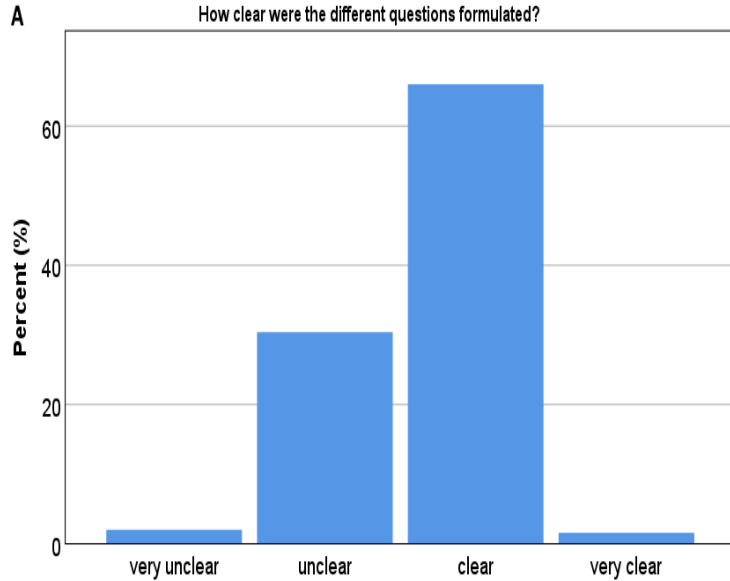
- Did the test once with a pass >70%
- Did the test multiple times even after passing
- Retook MCQ many times only to reach 70%

→students most active in afternoon



→students took the MCQ on average 3.9 times

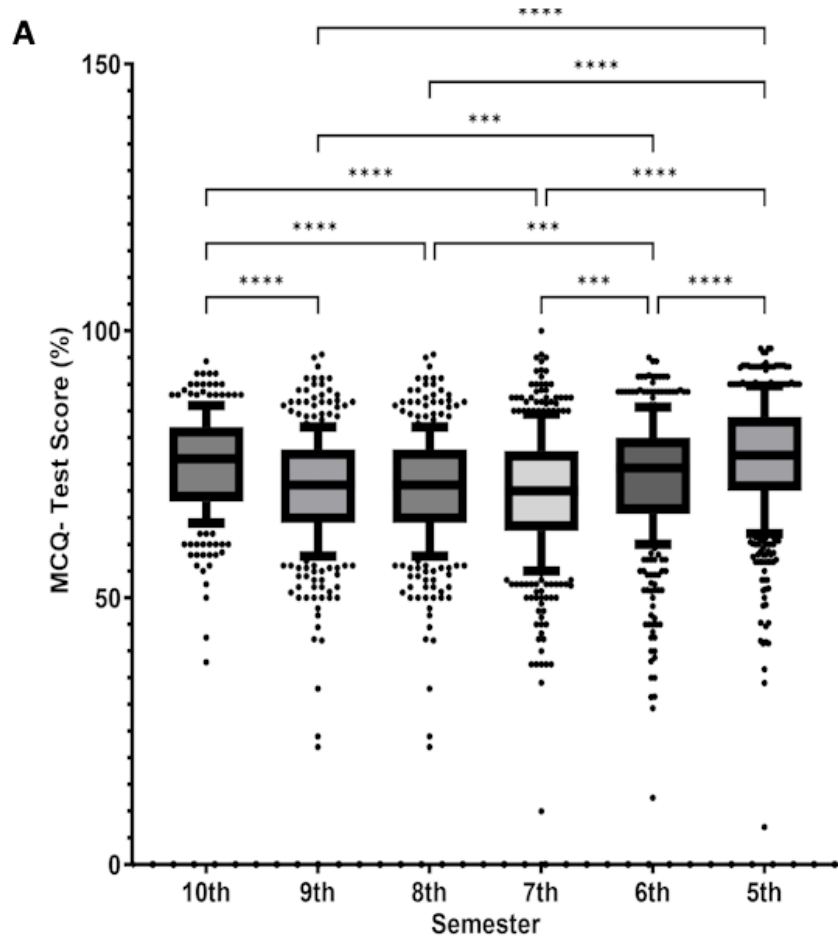




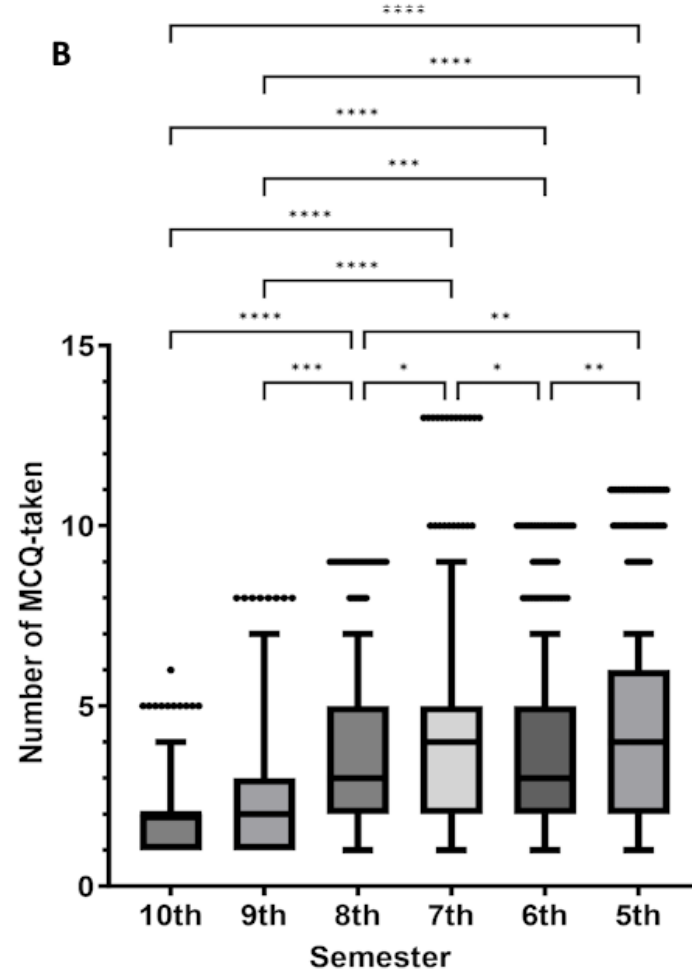
Spearman corrl.	How useful is such an MCQ test?
Semester	-0.114**
Time MCQ	0.029
Percent MCQ	0.083*
Number Of MCQ	-0.009

Small correlation if $0.1 < |r| < 0.3$, Medium corr. if $0.3 < |r| < 0.5$, Strong corr. if $0.5 < |r| < 1$, *. $P > 0.05$ level (1-tailed). ** $P > 0.01$ level (1-tailed).

Activity across the semesters



→ MCQ lowest for 7th and 8th sem



→ less retakes for 9th and 10th, highest for 7th

Student behaviour

Spearman correlation	How many hours do you use to read / study on your own during the week?
Percent MCQ	0.425**
Number Of MCQ taken	-0.357**
How clear were the different questions formulated?	0.416**
How many percent of the lectures this year have you participated in?	0.403**

Small correlation if $0.1 < |r| < 0.3$, Medium corr. if $0.3 < |r| < 0.5$, Strong corr. if $0.5 < |r| < 1$, *. $P > 0.05$ level (1-tailed). ** $P > 0.01$ level (1-tailed).

Did the MCQ change student behaviour?

Spearman correlation	Semester
have MCQ tests led you to checked questions lecture notes you are unsure about?	0.271**
have you started reading / exam preparation earlier than you would otherwise have done?	0.477**

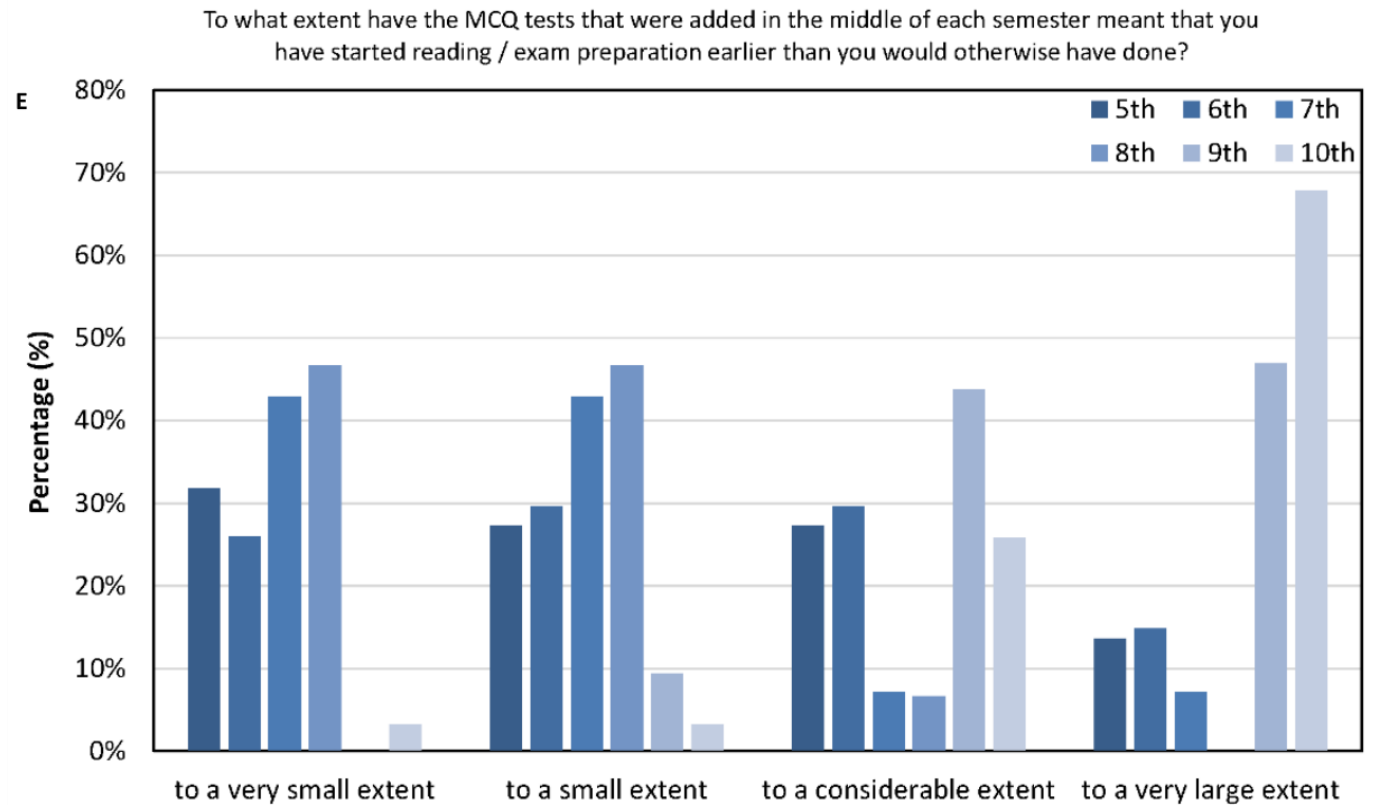
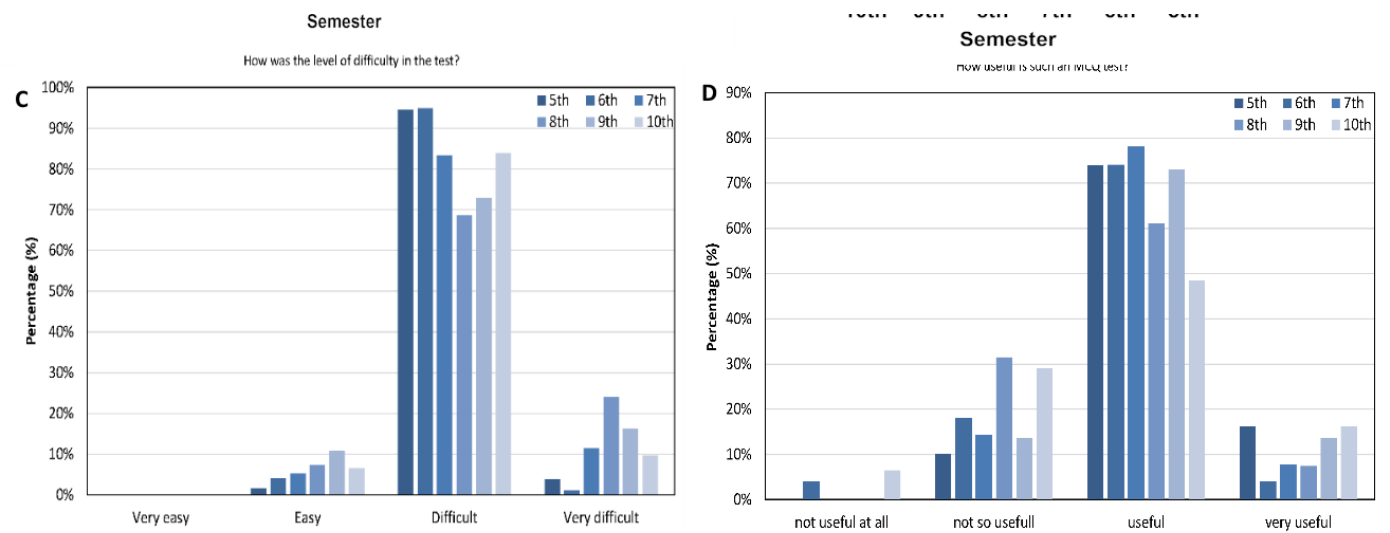


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Yes, our analysis showed **increased revision** amongst students as students progress through the semesters

Student behaviour

- Mostly predominated changes in earlier semesters



MCQ effects on student performance using regression analysis (least squares model).

- **Statistically significant model:** $F(5, 2063) = 47.25, p < 0.0001$.
- Model's R-squared value of **10.27%** indicates **limited explained variability**.
- Low multicollinearity among predictors (VIF values close to 1).
- **Significant predictors:**
 - Cohort ($p < 0.0001$)
 - Semester ($p = 0.0259$)
 - Number of MCQs taken ($p < 0.0001$)
- **Non-significant predictors:**
 - Student ($p = 0.8773$)
 - Time-When-MCQ-Was Taken ($p = 0.3220$)
- Intercept estimate: 66.53 (95% CI: 66.03 - 67.03, $p < 0.0001$).
- 'Cohort' had a strong positive effect on performance (Coefficient = 1.188).
- 'Number of MCQs taken' had a negative effect (Coefficient = -0.9557).



Conclusion

- Effective tool to increase student learning
- Increased knowledge basis for each discipline
- Implementation crucial for its success
 - Project led by academic staff together with experts in education, student and administration
 - Continuous monitoring and evaluation → quality assurance → evolution of MCQ → **required resources**
- Technical limitations, class frontier not ideal
 - Students reported that would like MCQ score broken down into individual discipline, not possible in FRONTER. Eg, MCQ score in Endo, Perio, Cario together with total MCQ score
 - FRONTER had difficulties in picking random questions from random semesters/discipline
- Tracking behaviour provided useful analysts



Conclusion

- **Correlations reveal complex dynamics between student habits, attendance, and performance.**
- **Significant correlation found between early exam preparation and improved student performance.**
- **Independent study hours and lecture attendance are significant predictors of performance:**
- **Clarity of MCQs and lecture attendance is key to enhancing performance**
- **Students were aware of their own performance as we tracked actual MCQ scores with expected score**

