

Impact of Frequency of Spaced Retrieval Using Repeat Testing on Knowledge Retention in Pharmacy Education

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Take-Home Points

- “Test-enhanced learning” is a strategy to enhance long-term knowledge retention
- When tested at different frequencies after initial assessment, retrieval practice with multiple choice questions (MCQs) did not improve asthma pharmacotherapy knowledge retention
- Future studies should explore the best format and frequency of retrieval to improve long-term retention in pharmacy

Background & Purpose

- Test-enhanced learning may improve knowledge retention, but the optimal format and frequency of retrieval is unknown to improve knowledge application
- **Purpose:** To apply spaced-retrieval in a practical context through repeated testing and to assess the effect of the frequency of spaced retrieval using repeat testing on knowledge depreciation in PharmD Program
 - Initial asthma pharmacotherapy assessment: November 2022 Final Exam in Patient Care 3 (PC3)

Methods

- Prospective, randomized, control trial of second-year PharmD students
- Students randomized into 3 groups that differed in frequency of repeated testing with identical five-MCQ retrieval practice assessments (RPAs) on asthma pharmacotherapy
 - Feedback (rationale) was provided for each RPA question
 - Each participant took a final asthma pharmacotherapy assessment that had different MCQs from the RPAs
- **Primary Outcome:** Comparison of final assessment scores between 3 groups

Results

Table 1. Timeline for RPA(s) & Final Assessment

Month	Group 1	Group 2	Group 3
Feb 2023 (RPA 1)	X		
April 2023 (RPA 2)	X	X	
May 2023 (Final)	X	X	X

Table 2. Patient Care 3 (PC3) Performance

Characteristic	Overall (N = 94)	Group 1 (N = 32)	Group 2 (N = 31)	Group 3 (N = 31)
Asthma iRAT score*	70 (30)	70 (20)	80 (27.5)	75 (30)
Asthma pharmacotherapy score on PC3 course exam*	71.4 (28.6)	--	--	--
Overall PC3 exam score, mean (SD)	85.2 (5.2)	85.5 (4.5)	85.2 (5.2)	84.9 (6)

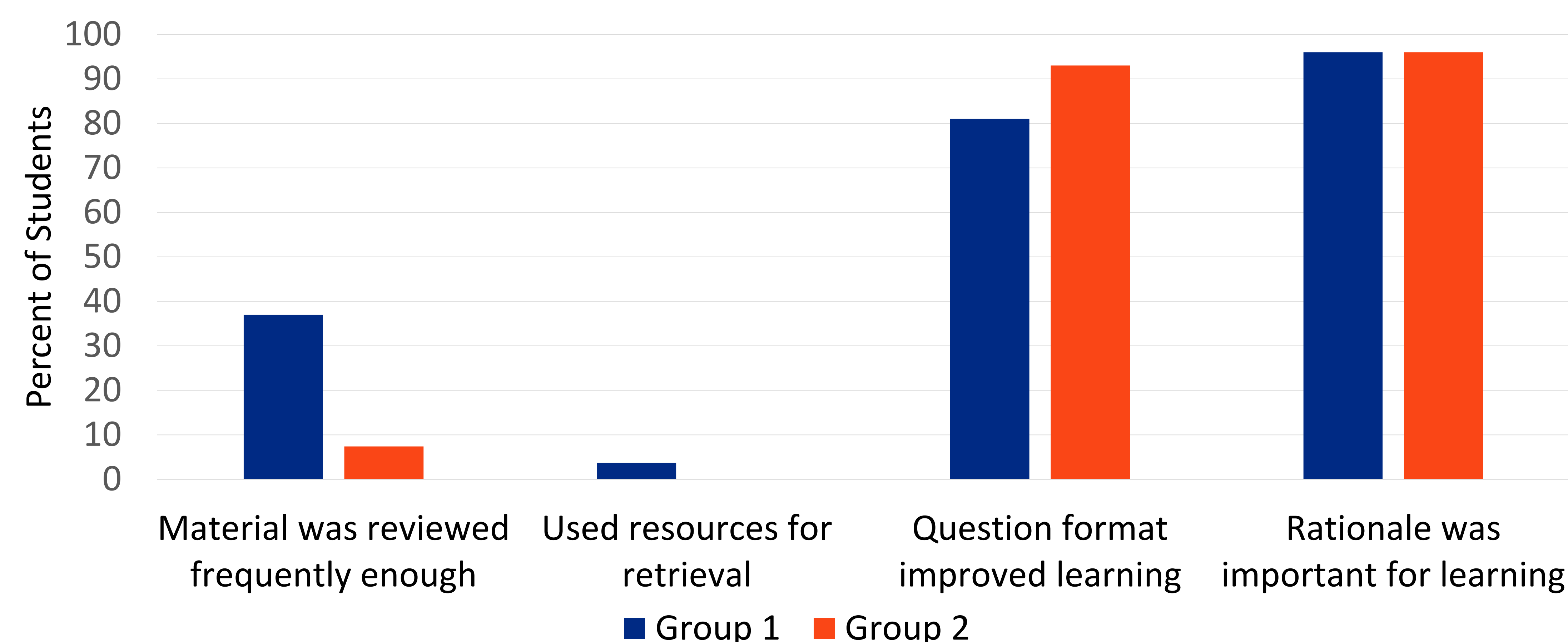
SD = standard deviation, iRAT = individual readiness assessment test, PC3 = patient care 3 course
*median (IQR)

Table 3. Comparison of Performance on RPA(s) and Final Assessment

	Group 1 (N=31)	Group 2 (N=29)	Group 3 (N=30)	p value
RPA 1	4 (1.5)	--	--	--
RPA 2	4 (1.5)	3 (2)	--	0.076
Final Assessment	3 (2) [‡]	3 (2) [‡]	3 (1.75)	0.75

Results reported as median (IQR); RPA = retrieval practice assessment
‡N=30, †N=28

Figure 1. Student Perceptions of Retrieval Practice



Discussion

- Participation in retrieval practice (Groups 1 & 2) did not improve performance on the final assessment compared to those with no retrieval practice (Group 3)
- Students agreed the question format and being provided answer rationale improved learning
- Factors impacting retention with test-enhanced learning
 - Feedback
 - Format/type of question (i.e. essay, short answer, MCQ)
 - Spacing of repeated testing (gap of RPA exposures)
 - Retention interval (time between final RPA and final assessment)
 - Knowledge transfer (differences between RPA and final assessment MCQs)

Limitations

- Voluntary student participation could have led to selection bias
- Small sample size may have limited the power to detect a difference between groups
- Not all participants completed all parts of the study
- Number of questions could have limited ability to detect a difference in performance improvement
- Time between initial assessment and the first retrieval practice may have been too long, leading to knowledge depreciation
- Work exposures could have impacted student performance

Future Research

- Explore modifying different study factors:
 - Question type, number, and similarity (transfer)
 - Spacing between initial knowledge acquisition and retrieval practice
 - Gap of time between retrieval practice and number of retrievals
 - Disease-state topic