Dyadic Explanations During Preparatory Self-study Enhance Learning: A randomized controlled study

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INTRODUCTION

Self-studying is an integral part of medical school. Yet, little is understood regarding the preparatory process of students. It is widely believed that enhanced preparation, via self-explanation, paves the way for successful learning. This study aims to prove the following hypotheses: (1) dyadic and self-explanation outperform passive video learning, (2) dyadic explanation is more effective than self-explanation, and (3) the effects are visible after learning and retaining new information. The research question identified is whether engaging students in self-explanations enhances student learning and retention.

METHODS

Participants
120 first and second-year students from a medical school in Singapore (72 M, 48 F) with a mean age of 20.08 years (SD = 1.04 years) were recruited. All participants had experience of team- based learning (TBL).[1-3]

Materials
A video-recorded lecture of a powerpoint presentation with voiceover commentary by a teacher was presented and a knowledge test known as concept retrieval technique (CRT) was conducted. 30 concepts were identified. Three CRTs were administered: a pre-CRT before watching the lecture, a post-CRT and a retention-CRT one week after. Two independent raters scored all CRTs ($\kappa = 0.66$, $P < .001$.)

Procedure
Participants were randomly assigned to one of four conditions: (1) an individual self-explanation condition and (2) a dyadic explanation condition. Students in the two control conditions either listened to the video-recorded lecture (3) once or (4) twice. Individual and self-explanation conditions were interrupted intermittently through the video.

The video-recorded lecture and all instructions were presented via Qualtrics. Participants were not allowed to take notes.

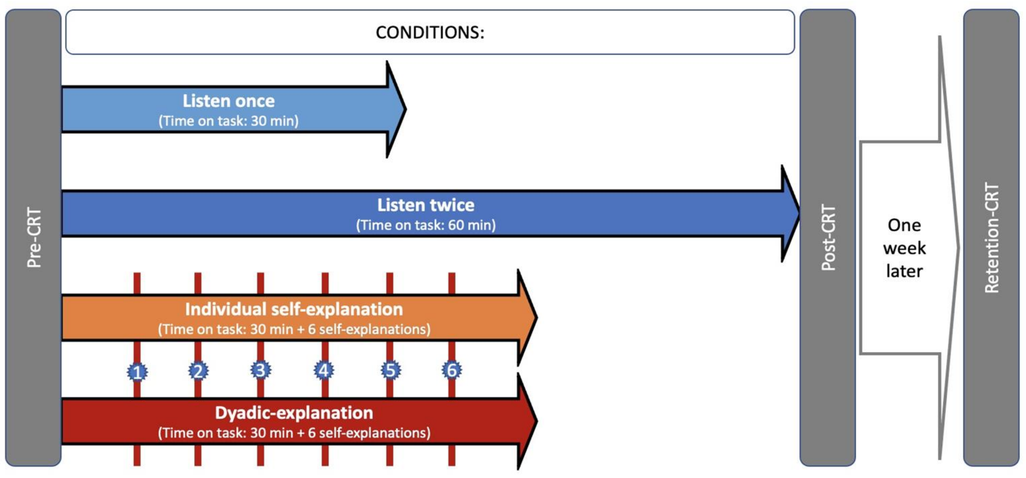

Figure 1. Study design: there are four conditions (1) listen once (30 min; (2) listen twice (60 min); (3) individual self-explanation (30 min + time for self-explanation); and (4) dyadic-explanation (30 min + time for self-explanation). At the end of each condition, the post-CRT was administered.

Analysis
Following blinding, we did a 2*2 repeated-measures ANOVA for the first hypothesis and used a 4*3 repeated-measures ANOVA for the second and third. We conducted a content analysis of the explanations and transcribed the CCTV footage of 360 explanations. Two independent coders segmented the utterances into 'idea units' [5,6] and coded these according to (1) referring to a previous segment of the lecture; (2) referring to own experiences; and (3) asking questions. We computed mean scores for the number of segments and determined the extent to which there were differences between the two groups by conducting three one-way ANOVAs.

RESULTS

Time Spent
Comparing individual self-explanation and dyadic explanations, there was no statistically significant difference in time taken for self-explanation.

CRT Scores
Post-CRT and retention-CRT scores were normally distributed while pre-CRT scores were not and there were no significant differences in participant's prior knowledge before the experiment.

Participants in the dyadic explanation condition scored significantly higher than the other three conditions and participants in the control conditions scored significantly lower than the individual and dyadic explanation conditions.

Hypothesis 1
Comparing to just listening to the video, individual self-explanation and dyadic explanation lead to better learning with a statistically significant interaction effect ($F = 5.67$, Wilks $\Lambda = 0.94$, $p = 0.19$, $\eta 2 = 0.05$)

Hypothesis 2 and 3
Dyadic explanation was more effective than self-explanation immediately after and one week after the learning event. ($F = 3.70$, Wilks $\Lambda = 0.83$, $p = 0.002$, $\eta 2 = 0.09$). There was no statistically significant difference in time taken for self-explanation.

Content Analysis
There were more references to the video content for individual self-explanations but this was not significant ($F= 0.31$, $P =.57$, $\eta 2 = 0.01$). There were no statistically significant differences between groups in reference to their own experiences ($F = 0.01$, $P =.91$, $\eta 2 = 0.0001$). However, there was a significant difference in asking questions ($F = 50.67$, $P =.001$, $\eta 2 = 0.50$) where participants in the dyadic explanation condition asked on average 24 times more questions than in individual self-explanation conditions.

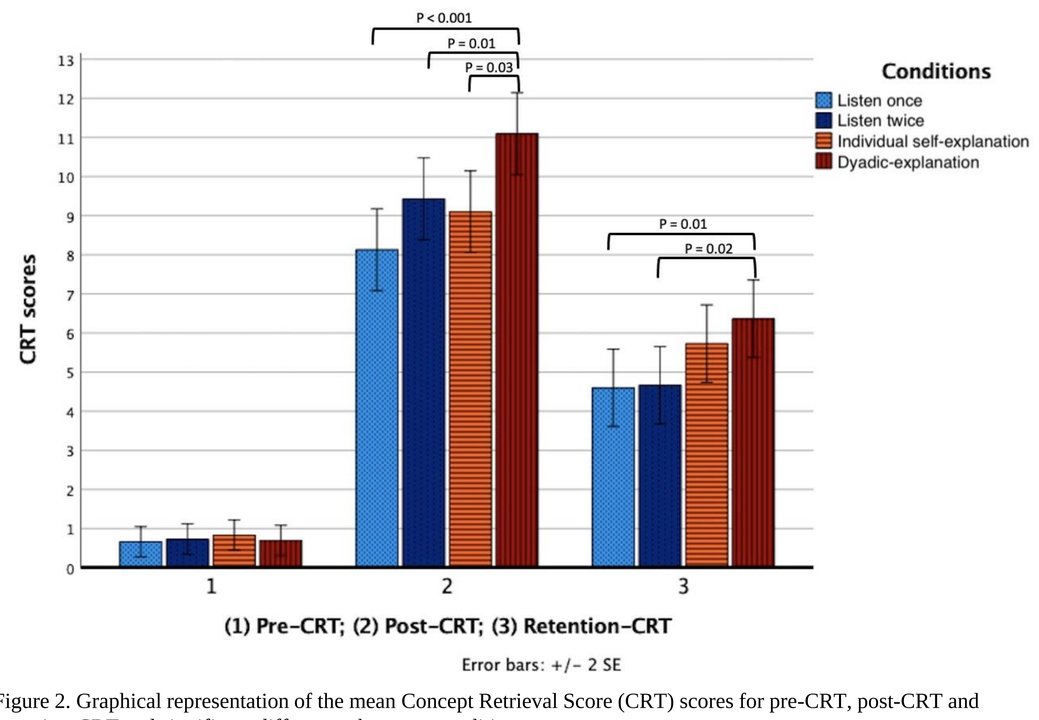

Figure 2. Graphical representation of the mean Concept Retrieval Score (CRT) scores for pre-CRT, post-CRT and retention-CRT and significant differences between conditions.

DISCUSSION

The objective of the study was to find out if self- and dyadic explanations are beneficial to learning and retention. Compared to control conditions, self- and dyadic explanation conditions significantly gained more and retained knowledge better. Additionally, dyadic explanation gained more knowledge than all other conditions.

Conclusion
The group using dyadic explanation consistently out-performed the other three conditions.

Future studies could determine (1) if the above methods can enhance learning for text materials, (2) if students would spontaneously engage in self-explanation if not induced and when they would do so, and lastly (3) if these methods would benefit complex topics than less complex topics.

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