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## Introduction

- Potency ( $\Delta 9$ -THC) and prevalence of cannabis use and Cannabis Use Disorder (CUD) are rising and are linked to poor mental health, cognitive, and decision-making outcomes (Crean et al., 2011; Hasin et al., 2016; Kim-Spoon et al., 2019; Petker et al., 2019).
- Treatment seeking is common and effective, but many don't respond. Understanding cognitive and decision-making vulnerabilities associated with cannabis use and misuse may inform treatments. **Examples include targeting cognitive and decision-making deficits associated with cannabis misuse.**
- Episodic memory (EM):** The ability to learn and recall contextual details of past personal experiences is robustly associated with problematic and heavy patterns of cannabis use (Crane et al., 2012; Dickerson & Eichenbaum, 2010; Petker et al., 2019). **Intervention for Targeting EM: Episodic Specificity Induction (ESI), which enhances episodic memory, episodic detail and creation of alternative future events** (Thakral et al., 2019; Madore et al., 2014).
- Delay discounting (DD):** Inability to value the future: Excessive devaluation of future rewards tends to relate to more frequent and problematic use (Sofis et al., 2020). **Intervention for Targeting DD: Episodic Future Thinking (EFT), a brief mental simulation of positive and personally relevant future events which is compared to the control condition of Episodic Recent Thinking (ERT), which probes recall of positive events from yesterday.**
- Pilot Study (Sofis et al., 2020)**
  - Participants were randomized into two groups (i.e., ESI-control + ERT vs. ESI + EFT). Those receiving the ESI and EFT trainings showed lower DD and higher ratings of vividness, enjoyment, excitement, and importance (Quality Ratings) of future events relative to the attentional control group in a sample of regular cannabis users.
- Current study:** Examined if Domain-specific EFT (DS-EFT), which prompts participants to create and imagine future events in multiple life domains (social, leisure, career/financial, and health) would engender greater reductions in DD and cannabis use than traditional-EFT and ERT when comparing changes in cannabis use (week prior to week after).
  - Tested whether reduction in DD mediated the effect of DS-EFT on cannabis use.

## Method

- Recruitment**
  - 90 participants recruited via crowdsourcing platforms (Amazon mTurk, Qualtrics Panels)
  - Inclusion: >99 lifetime cannabis use days, >9 days of use in past month, DD > -7.39.
  - Administered to participants online through their computer or smartphone using Qualtrics.
- Baseline (Day 1)**
  - Timeline Follow-Back (TLFB) assessed days of use and daily grams used in past week
  - Measures: **DD** (five-trial task); **Hypothetical Purchase Task (Demand)** – joints of cannabis
- Intervention (Day 2; Randomization to ERT, EFT, or DS-EFT)**
  - All participants received ESI, followed by the ERT, EFT, or DS-EFT training
  - Measures: DD and **Hypothetical Purchase Task**
- Follow-up (Day 9)**
  - Measures: TLFB, DD
- Analyses**
  - Structural equation modeling (SEM) used to examine change in DD as a mediator of relationship between intervention group and change in cannabis use and to examine latent change in total grams and days of cannabis use (baseline week vs. follow-up week)

## ESI Induction

### Watched 2-minute video



Answered a series of seven open-ended questions prompting recollection of specific details (who, what, when, where) of a video of a tiny house tour.

### Traditional-EFT (n=26)

- Answered a series of questions that prompt the creation of positive, realistic future events (e.g., What will you be doing?)
- Future times:** 1 day, 1 week, 1 month, 1 year

### DS-EFT (n=29)

- Similar to Traditional-EFT, except all time frames are 1 year in the future and each event is created within a life domain (social, leisure, career/financial, health)
- Future times:** 1 year, 1 year, 1 year, 1 year, 1 year

### ERT (n=35)

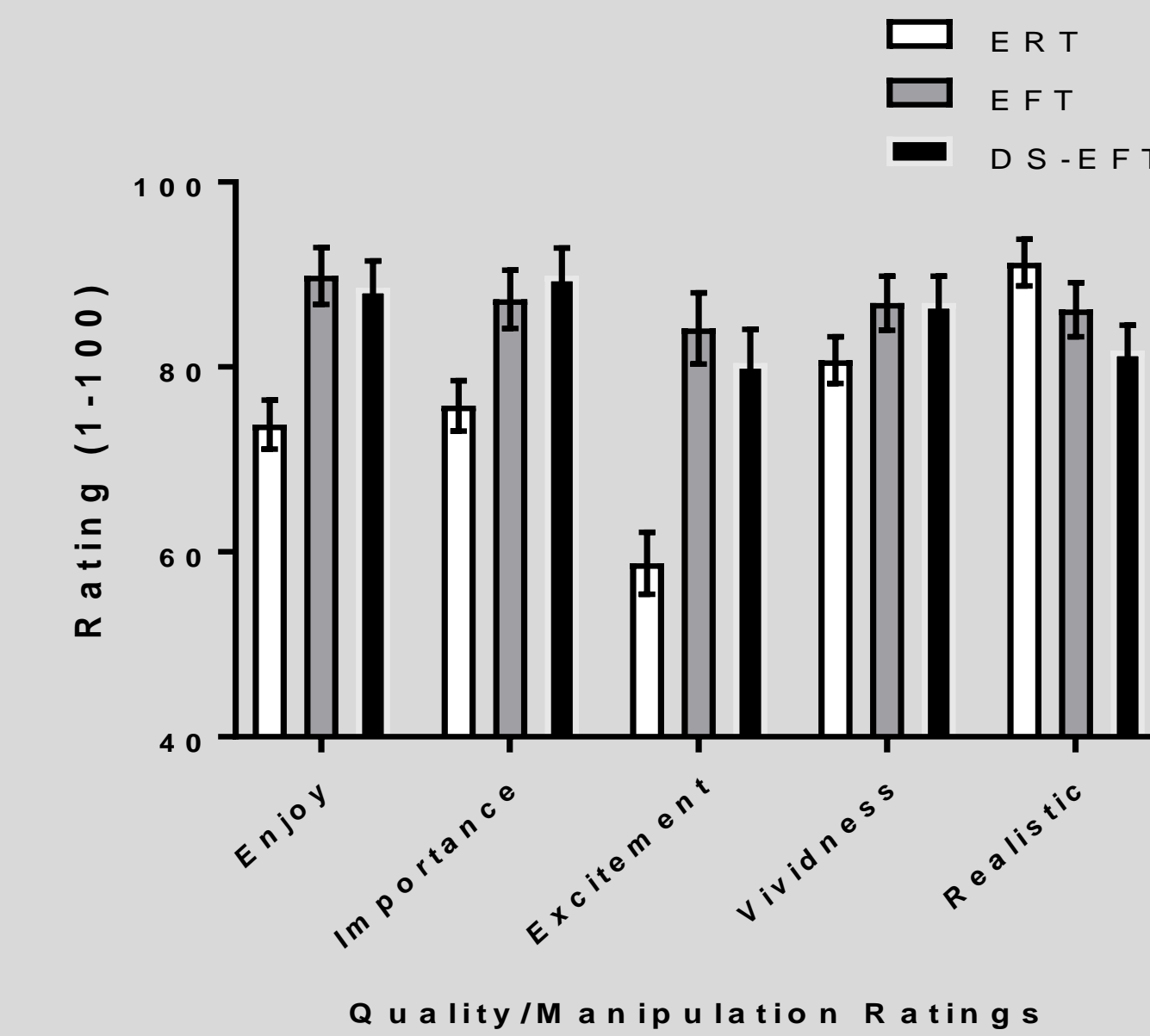
- Similar to Traditional-EFT, except references time periods of past events from yesterday.
- Past times:** 7-10 pm, 4–7 pm, 1-4 pm, 10-1 pm, 7-10 am

All conditions created written cues for each event (e.g., "In 1 year, I will be at my son's birthday party eating cake as he opens his presents")

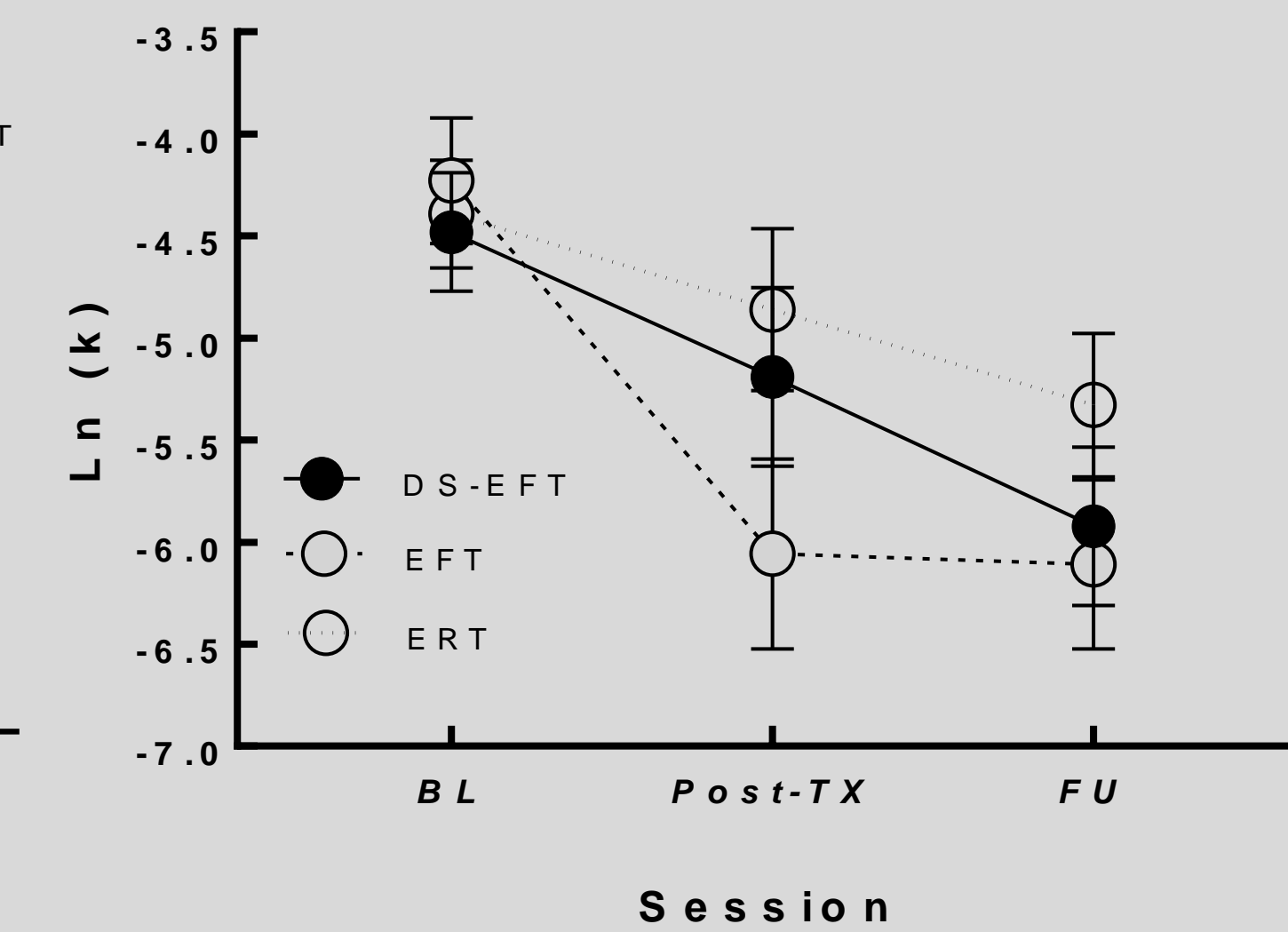
## Results

	Continuous (M, SD)	Overall	ERT	EFT	Framed EFT	p value
Age	41.0 (13.1)	41.0	42.7 (13.7)	40.7 (12.1)	39.2 (13.6)	.58
Readiness to Change Cannabis (1-10)	2.4 (1.8)	2.4	2.5 (1.7)	2.3 (1.9)	2.2 (2.0)	.84
Delay Discounting (Ln (k))	-4.4 (1.5)	-4.4	-4.4 (1.8)	-4.1 (1.4)	-4.6 (1.2)	.58
Ordinal (Mdn; IQR)						
<b>Cannabis</b>						
Days of Use (Past 30)	7 (5, 8)	7	7 (4, 8)	6 (5, 8)	8 (5, 8)	.84
Times/Day	3 (2, 4)	3	4 (2, 6)	3 (3, 4)	3 (3, 5)	.75
<b>Alcohol</b>						
Days of Use (Past 30)	2 (1, 4)	2	2 (0, 3)	2 (1, 3)	3 (1, 4)	.07
Alcoholic Drinks/Day	3 (2, 6)	3	2 (2, 3)	3 (2, 8)	4 (2, 7)	.30
<b>Nicotine</b>						
Days of Use (Past 30)	7 (3, 7)	7	7 (2, 7)	7 (3, 7)	7 (2, 7)	.99
Times/Day	6 (2, 7)	6	6 (2, 7)	6 (2, 7)	6 (3, 7)	.95
Categorical (n, %)						
CUD (no/yes)	40 (44)	40	18 (51)	11 (42)	11 (38)	.54
<b>Gender</b>						.56
Female	35 (39)	35	14 (40)	8 (31)	13 (45)	
<b>Level of Education</b>						.33
No College Degree	62 (69)	62	21 (60)	20 (77)	21 (72)	
<b>Employment</b>						.61
Full-time	53 (59)	53	18 (51)	17 (65)	18 (62)	
Part-time	11 (12)	11	3 (9)	4 (15)	4 (14)	
Retired/Disabled	16 (18)	16	8 (23)	4 (15)	4 (14)	
Unemployed	10 (11)	10	6 (17)	1 (4)	3 (10)	

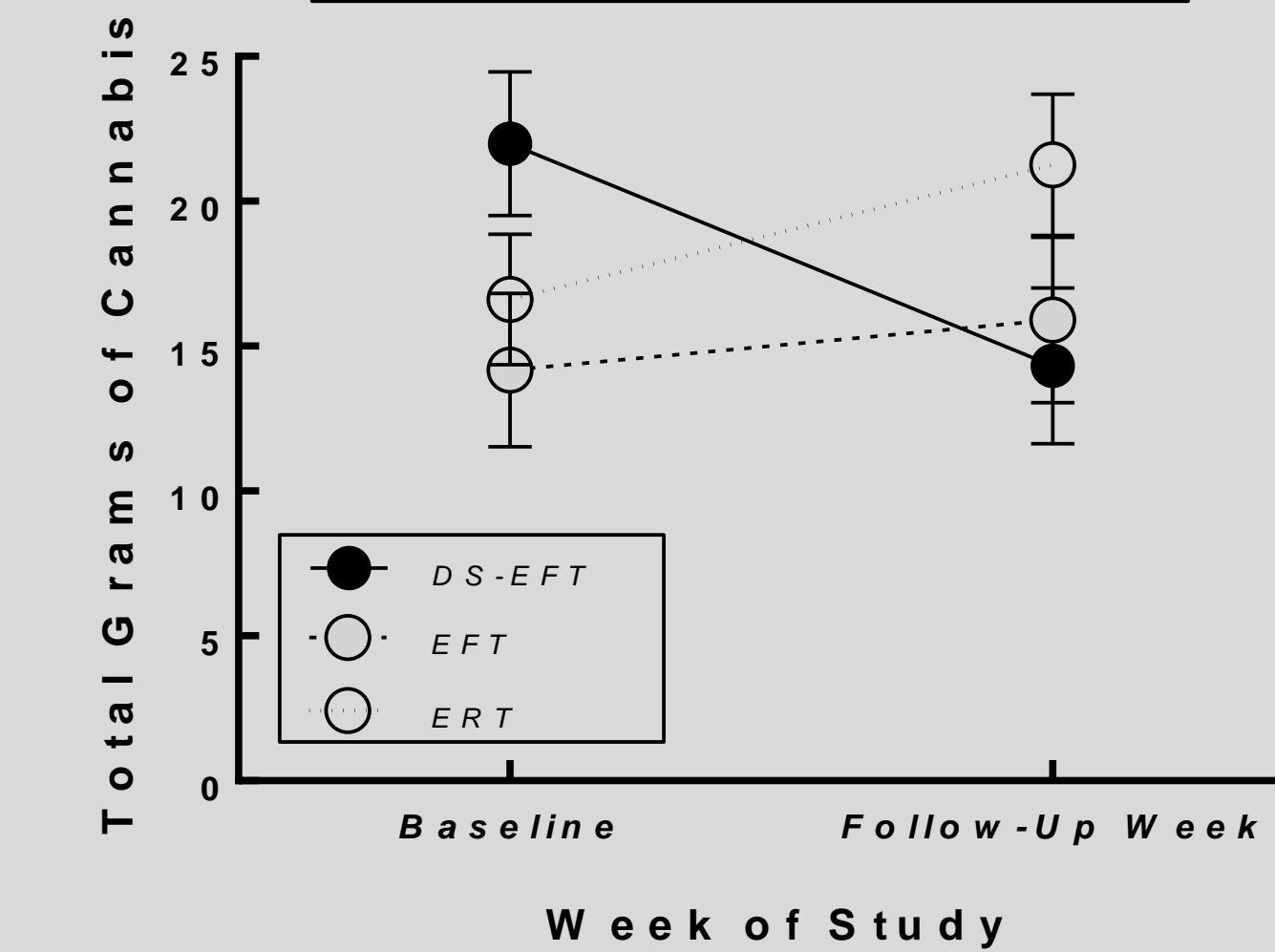
## Group Differences in Quality Ratings



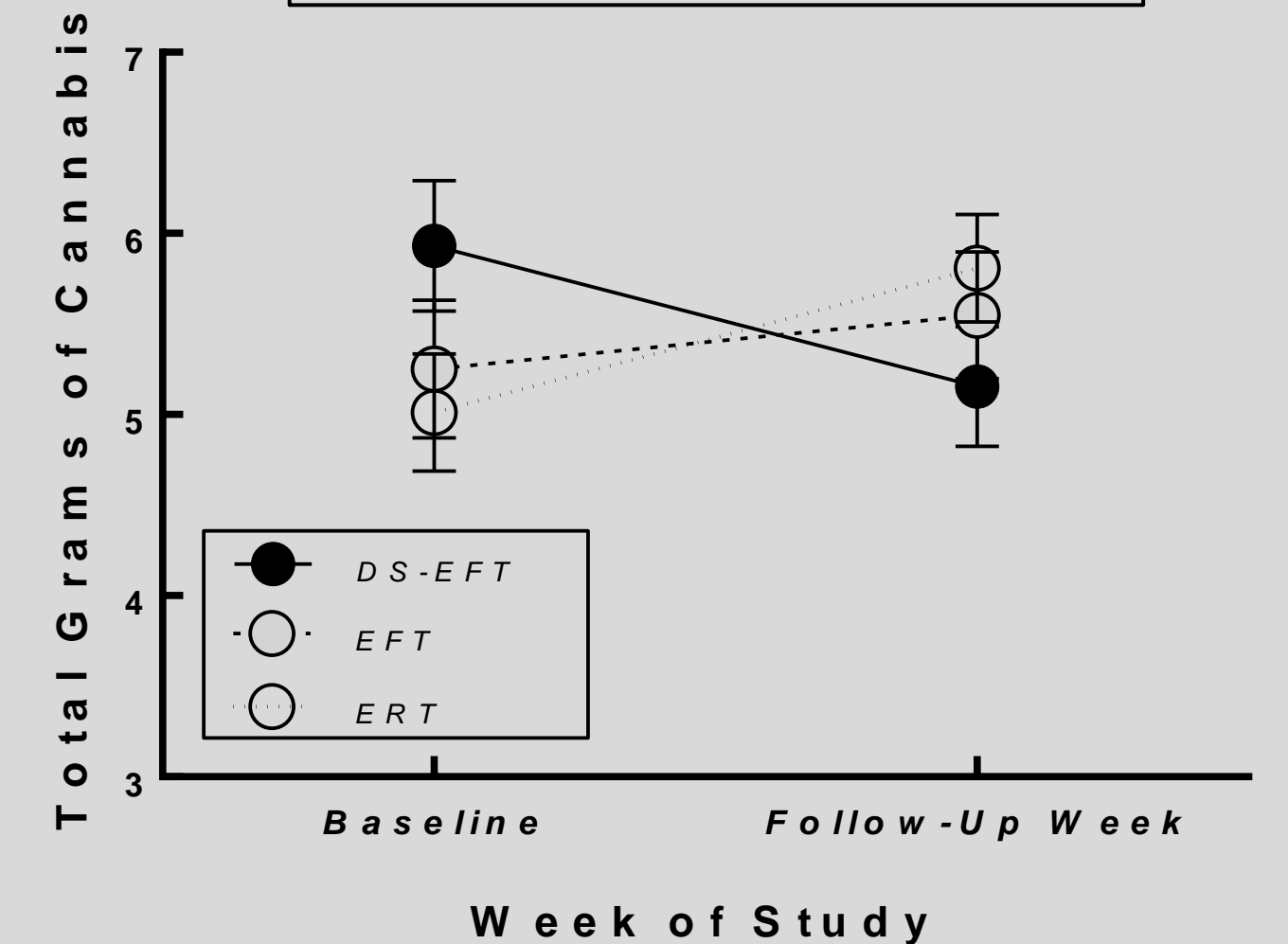
## DD of Groups Across Sessions



## Change in Total Grams



## Change in Total Days



- DS-EFT vs. ERT ( $d = .55, p < .01$ )
- DS-EFT vs. EFT ( $d = .19, p = .36$ )

- DS-EFT vs. ERT ( $d = .50, p = .02$ )
- DS-EFT vs. EFT ( $d = .26, p = .22$ )

## Conclusion

- Days and total grams of cannabis use were reduced in DS-EFT relative to traditional EFT and ERT (moderate to large effect) despite a generally low desire to reduce cannabis use.
- Change in cannabis use not mediated by DD, nor were there group differences
  - ESI may have reduced DD across groups?
- These findings suggest that DS-EFT may reduce cannabis use via a construct(s) other than DD.
- Immediately after the training, both EFT and DS-EFT groups reported greater quality (more enhanced episodic thinking) of events than the ERT group, but the DS-EFT training may have produced a more generalized enhancement of episodic thinking which may have resulted in the observed reduction of cannabis use in the DS-EFT group.

## Acknowledgements

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