

# **Decreasing Extraneous Cognitive Load Through Use of a Clinic First Scheduling Model**



Lindsey Porta, M.D., Clara Wang, M.D., Andrew Le, M.D., Nina Ruedas, M.S., LMFT, Asma Jafri, M.D. UC Riverside School of Medicine, Riverside, CA, USA

#### Background

Cognitive Load Theory (CTL) is foundational in the study of adult learning processes, including modeling the creation of long-term memory. The theory postulates that information is processed in the limited working memory before being stored in long-term memory. According to CLT, sustainable learning with long-term memory is dependent upon the limited elements of the working memory. These elements can be differentiated by their learning value as intrinsic. extraneous, and germane.

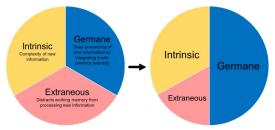


Figure 1: Working memory consists of intrinsic, germane, and extraneous cognitive load. Intrinsic cognitive load is derived from the inherent difficulty of a topic. Germane cognitive load is generated by the processing of schemas. Extraneous cognitive load is dependent on the manner in which information is presented to learners. As intrinsic cognitive load is fixed, decreasing extraneous load will increase in germane cognitive load,

Decreasing extraneous load is a key strategy to facilitate learning in medical education<sup>6</sup>. Learning environments with burdensome extraneous elements leave little room for intrinsic and germane elements, which ultimately impacts the formation of long-term memory or genuine learning, 6 The working memory should therefore ideally house an appropriately complex intrinsic load with minimal extraneous load, leaving more cognitive capacity for germane load.

The lack of consistent clinic scheduling in residency programs negatively impacts learning for trainees. Clinic First Models have been implemented in certain programs to improve trainee learning PGY3s Clinic First models prioritize continuity of care in the outpatient setting (Zeller) which may improve resident learning by decreasing extraneous cognitive load as postulated by CLT. Residency training an can impose a heavy extraneous load on learners with the need for onboarding at each new site and learning the nature of the workflow. These tasks have little to no educational value yet consume a large portion of residents' working memory. increase

This study evaluated the efficacy of a novel Clinic First scheduling model in optimizing the working memory for residents and therefore improving learning. We hypothesize that the implementation of a Clinic First Model will decrease the extraneous cognitive load in the working memory by reducing clinically irrelevant information. preparation

### Methods

The UCR Family Medicine residents participated in a retrospective cohort survey with questions modeled after validated tools used to measure extraneous cognitive load in similar settings7.8.9. The survey evaluated seven components of extraneous load; clarity of clinic workflow, familiarity of clinic, patient engagement, result follow-up, patient continuity, reliability of schedule, and innate preparation.

The survey was administered via an anonymous web-based application to include 2 sets of 7 closed-ended questions matched into cohorts of before and after the implementation of the Clinic First Model with 4 weighted answer choices.

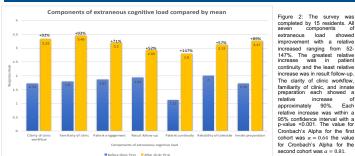
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Relative difference between cohorts stratified by training yea Figure 3: When stratified by training year, both training Δ25% vears reported a relative increase in all seven components. The largest relative increase continued to be patient continuity for both PGY2s and PGY3, However, 1000 reported 185% increase and PGY2s reported 120% increase, the difference between these groups was 65%. PGY3s reported the larger relative A 25% for patient engagement, result follow-up, patient continuity, and reliability of schedule. While PGY2s reported the larger relative increase in clarity of workflow, familiarity of clinic, and innate

# Discussion

Our results show a dramatic and statistically significant improvement in extraneous cognitive load after the implementation of the Clinic First scheduling model. Through the use of previously validated survey questions, we are confident that our survey validly assessed extraneous cognitive load rather than simple resident satisfaction in the scheduling model. Furthermore, our data proved to be reliable and significant thus supporting our hypothesis.

According to CTL, decreasing extraneous cognitive load inherently increases germane load thus fostering the storage of information into long-term memory. As the results support the reduction of extraneous load, it is understood there was a equal increase in germane load. This increase should translate to more clinically and academically pertinent information stored in long-term memory.

The improvement in extraneous cognitive load was unanimous for both PGY2s and PGY3 indicating that improvement is attributable to the scheduling model rather than natural training progression. The variation in degree to improvement in each extraneous load component is consistent with natural training progression which was expected and again supports that the improvement was secondary to the scheduling model prioritizing continuity rather than clinical experience.

This study is unique by linking Cognitive Load Theory with clinic continuity. It demonstrated a measurable reduction in extraneous cognitive load and strongly supports clinic continuity as imperative to resident learning. Therefore, reducing extraneous cognitive load through a clinic scheduling model that prioritizes continuity is essential in educating future physicians.

# **Future Considerations**

- This study was limited by both duration and sample size. Future studies would ideally involve regular surveys over all three years of training and larger sample sizes.
- This study currently lacks a control group. Graduates of the program from prior to the implementation of the clinic first model could be contacted to serve as a control, however recall bias would need to be accounted for.
- · Future studies may assess the impact of decreased cognitive load on clinical outcomes via assessment of various patient-centric metrics or surveys.
- Further evaluation of any increase in germane cognitive load could be explored by identifying if there is a corresponding increase in academic performance. Metrics may include ITE/board scores or resident competency evaluations.

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#### Results

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