

# Investigating the Impact of Experience on a User's Ability to Perform Hierarchical Abstraction



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## Motivation

It is intractable for a robot to be pre-programmed to do every task in every setting. One solution is to allow robots to learn new skills in situ, from end user demonstrations.



Demonstrators are capable of teaching a robot skills, when explicitly instructed on how to do so using instructional materials [1]. However, if not prescribed how to teach the robot, end users struggle to provide demonstrations that exhibit abstractions sufficient for a hierarchical task [2].

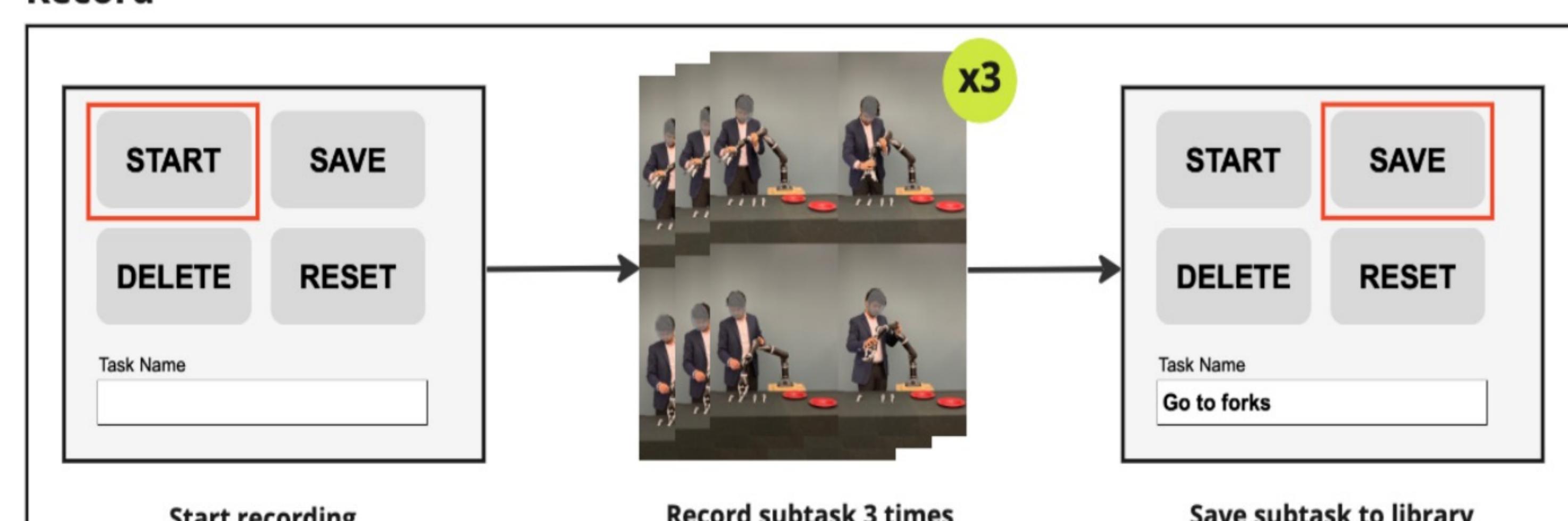


Demonstrators must be trained in order to provide demonstrations that would be usable, and this training is often *domain-specific*.

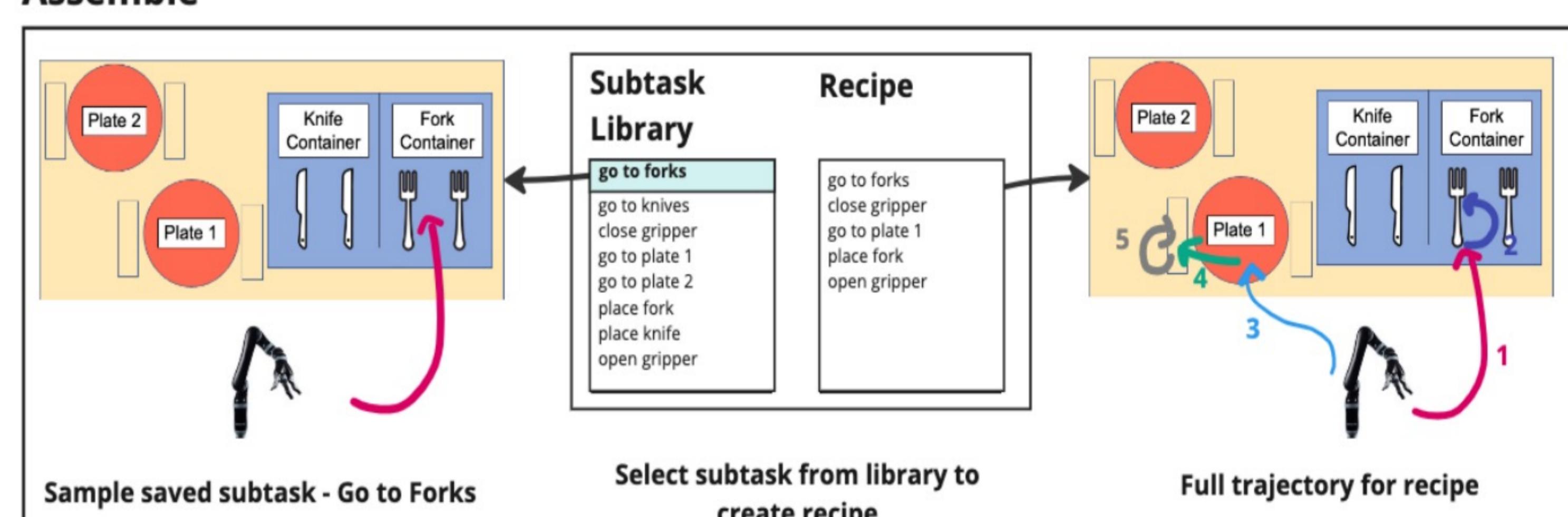
## Approach

We investigate whether users improve their ability to teach the robot over time, as they accumulate experience providing kinesthetic demonstrations in various domains.

### Record

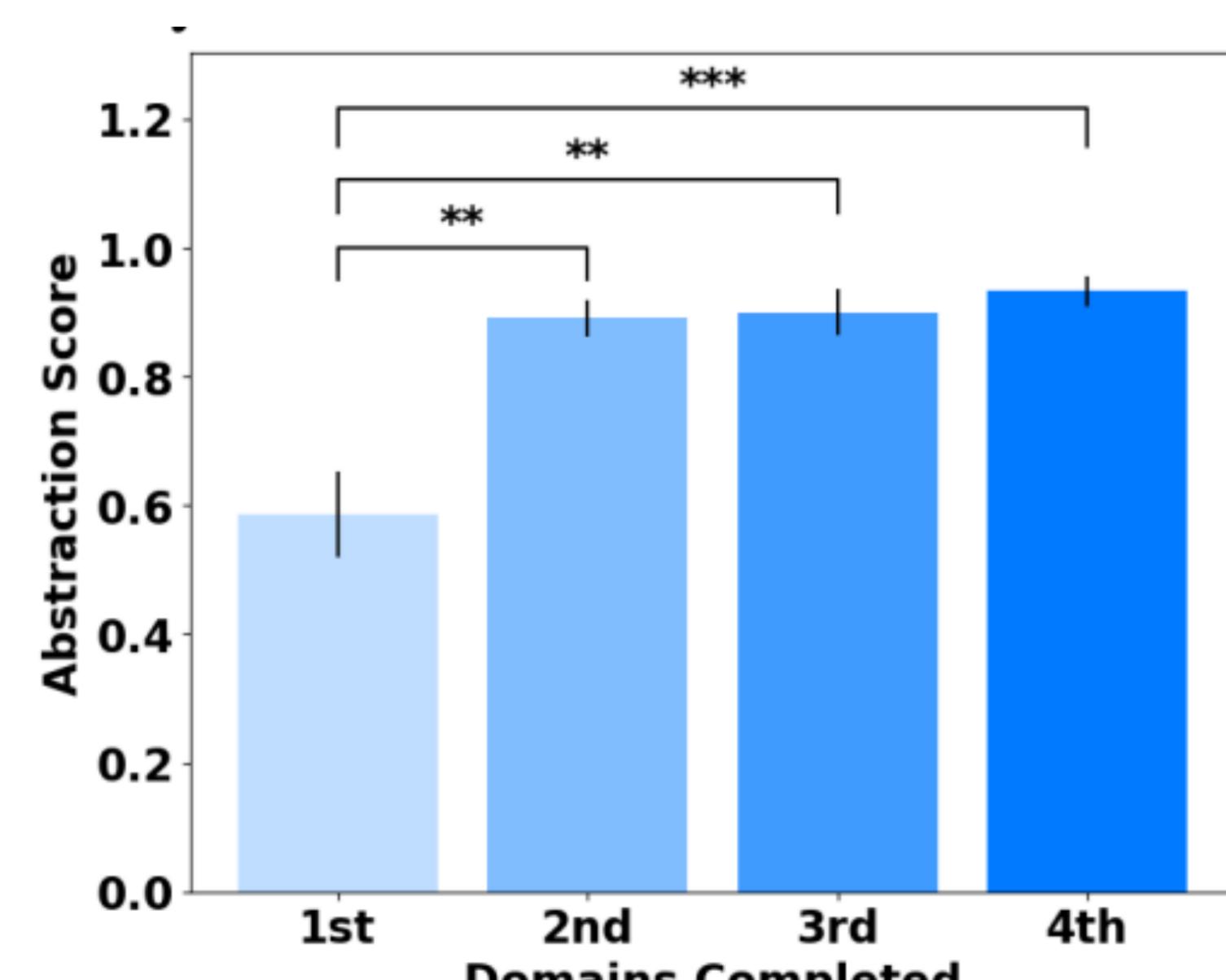


### Assemble

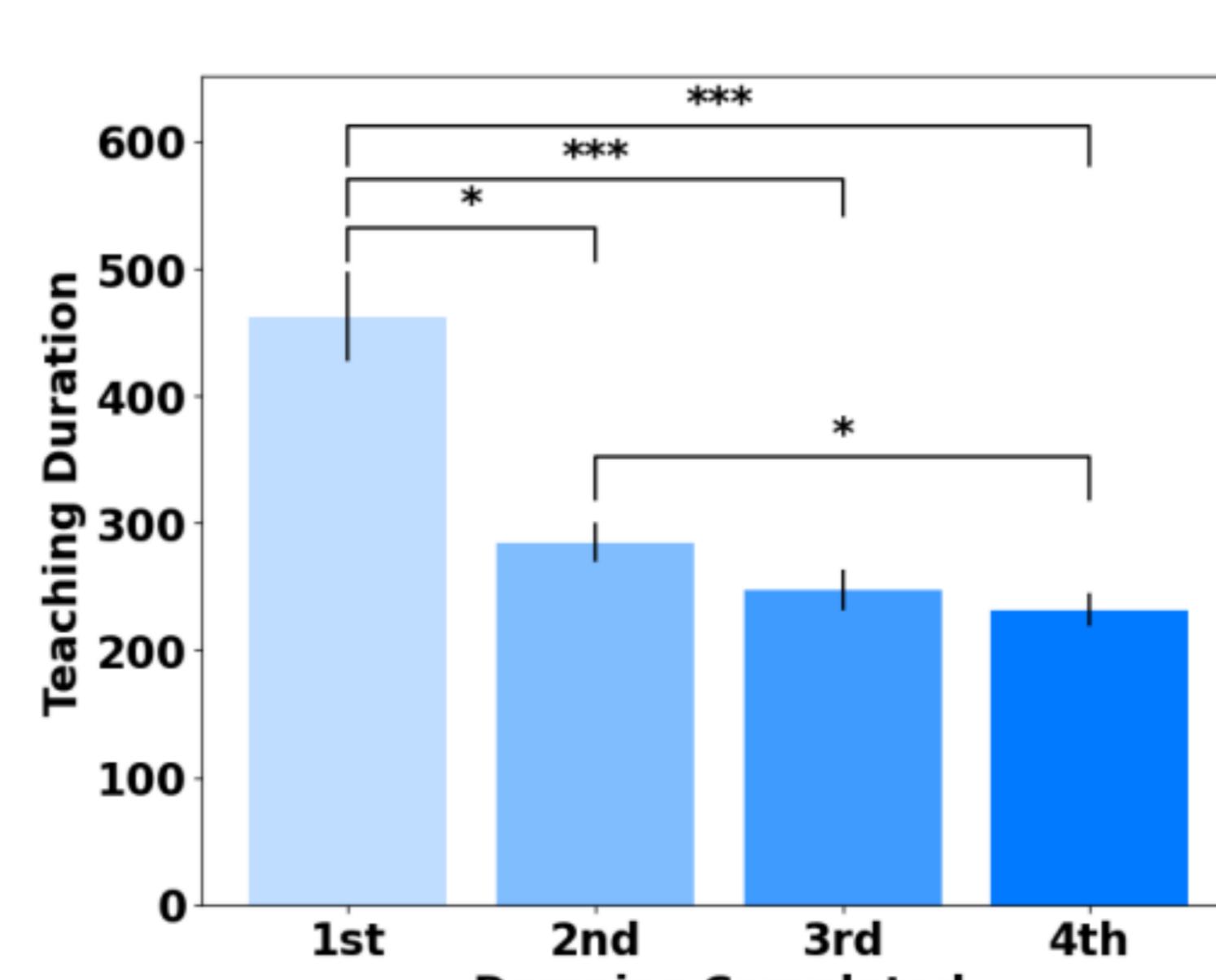


## Results

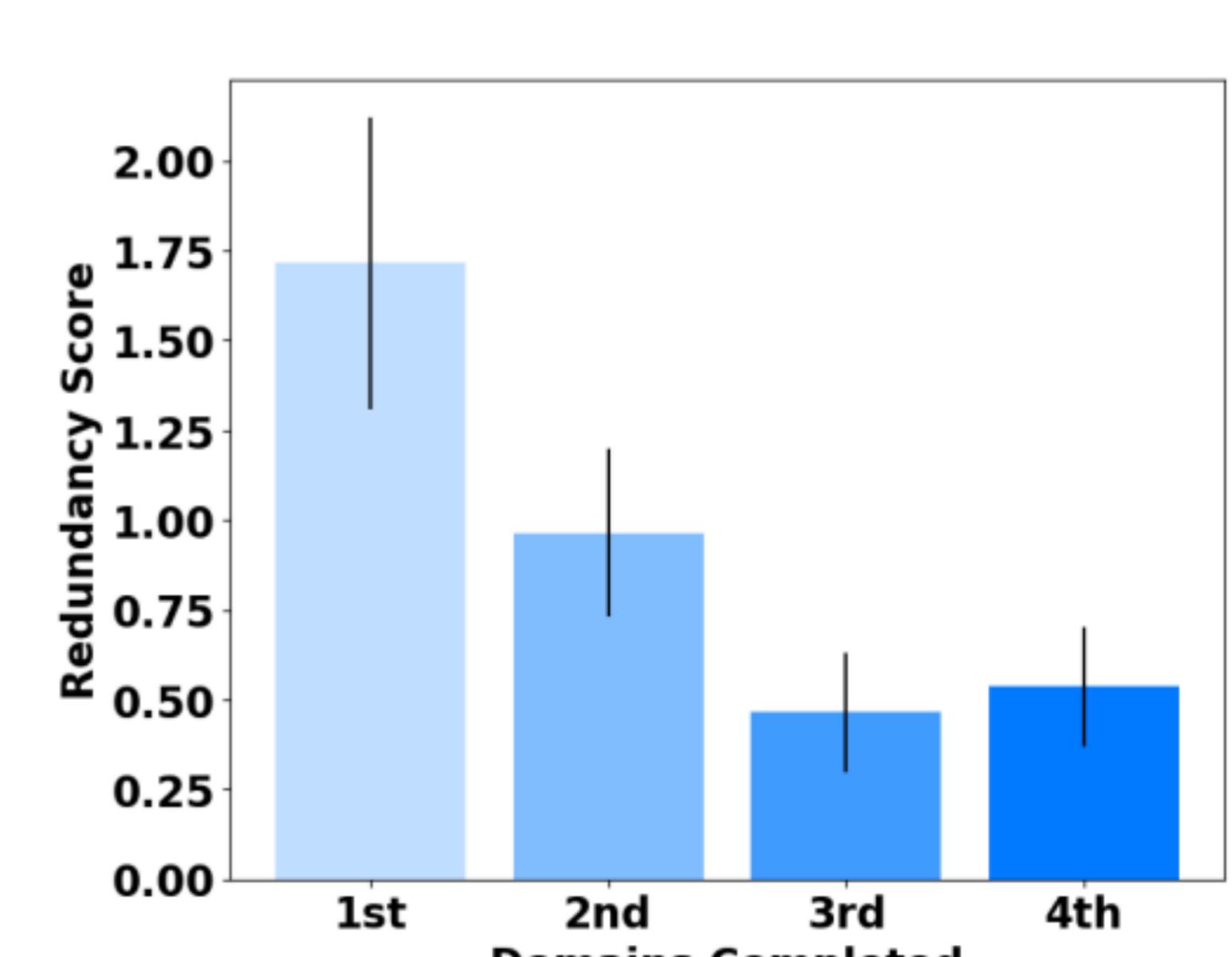
We find that as participants gain domain experience they are able to generalize knowledge to novel task domains. We show that with a few hours of training, we can teach human demonstrators to provide sufficient, necessary, and efficient demonstrations in novel domains.



**Takeaway 1:**  
Participants are better able to perform task abstraction with more domain experience.



**Takeaway 2:**  
Participants provide demonstrations more efficiently with more domain experience.



**Takeaway 3:**  
Participants provide fewer redundant demonstrations with domain experience.

## References

[1] M. Cakmak and L. Takayama. Teaching people how to teach robots: The effect of instructional materials and dialog design. 2014 9th ACM/IEEE International Conference on Human-Robot Interaction (HRI), pages 431–438, 2014.

[2] Nakul Gopalan, Nina Moorman, Manisha Natarajan, and Matthew Gombolay. Negative result for learning from demonstration: Challenges for end-users teaching robots with task and motion planning abstractions

