

Failing Together: Interactive Patterns of Problem-Solving between Youth and Educators in Informal STEM Environments

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Background

- Failure supports creativity and learning but is often overlooked in 21st-century education discussions.
- More research is needed on how failure shapes expertise and how to help students navigate it, especially in STEM.

Methods

- We used the Generalized Sequential Querier (GSEQ 5.1) software to conduct sequential analysis based on the interactions between the educators and the learners in 38 self recorded videos
- 61% of videos included educators with less than 5 years of experience and 39% of videos included educators with five or more years of experience



This material is based upon work supported by the U.S. National Science Foundation under Grant No. 2005927 (Binghamton University) and Grant No. 2005860 (Indiana University). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the U. S. National Science Foundation.

This study shows that interactions between educators and learners are *shared efforts*, with *prompting* being the most effective strategy for guiding learners through *problem-solving and failure*. More experienced educators tend to work more collaboratively, while less experienced ones rely more on direct instruction.

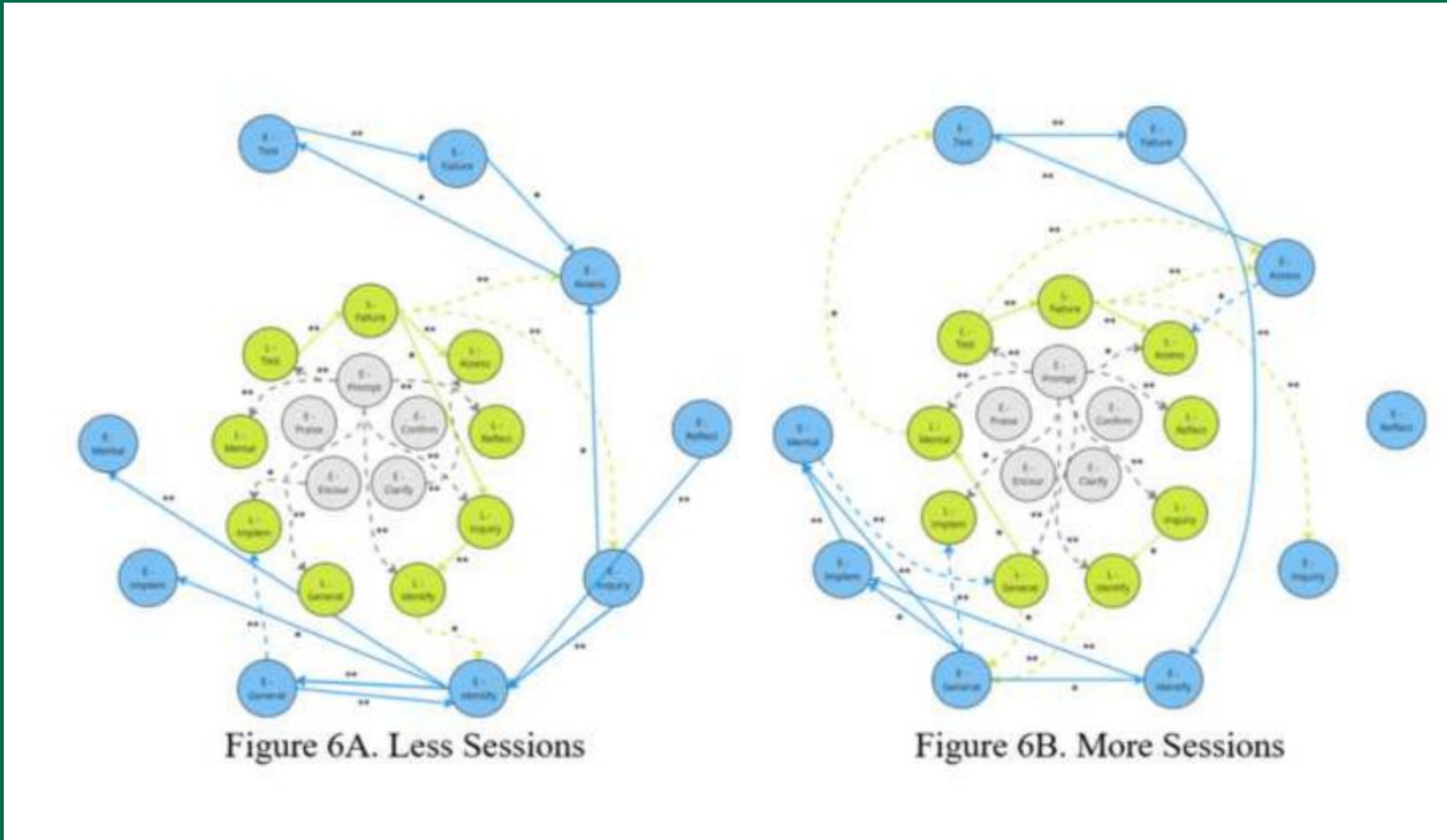


Figure 6. *Comparing Educator-Learner Interactions by Educator Experience Level*
Note. * $p < .05$. ** $p < .01$. ‘Less’ indicates sessions with Educators who have less than 5 years of experience. ‘More’ indicates sessions with Educators who have 5 or more years of experience.

Code Book

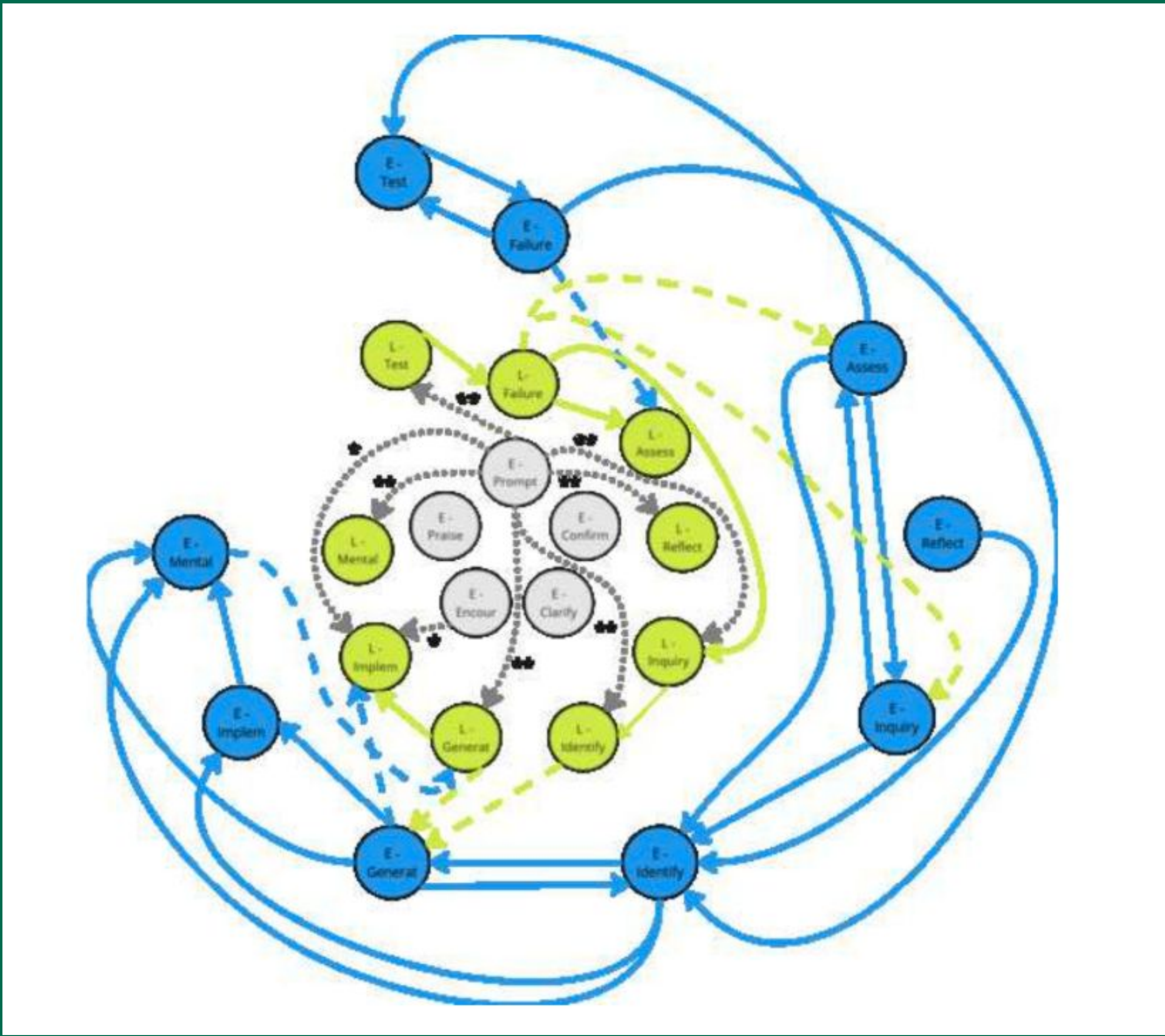


Figure 5. *Educator's Instructional Moves Within the Failure-Based Problem-Solving Cycle Framework*
Note. * $p < .05$. ** $p < .01$. Asterisks are only included for instructional moves. Asterisks between Learner □□ Learner, Educator □□ Educator, and Educator □□ Learner are no different from those in Figure 3 and Figure 4.

Theoretical Framework

- Coding was informed by the failure-based problem-solving cycle by Tawfik et al. (2015). Developed using frameworks, theories, and associated research relevant to the concept of failure, this cycle is composed of nine elements

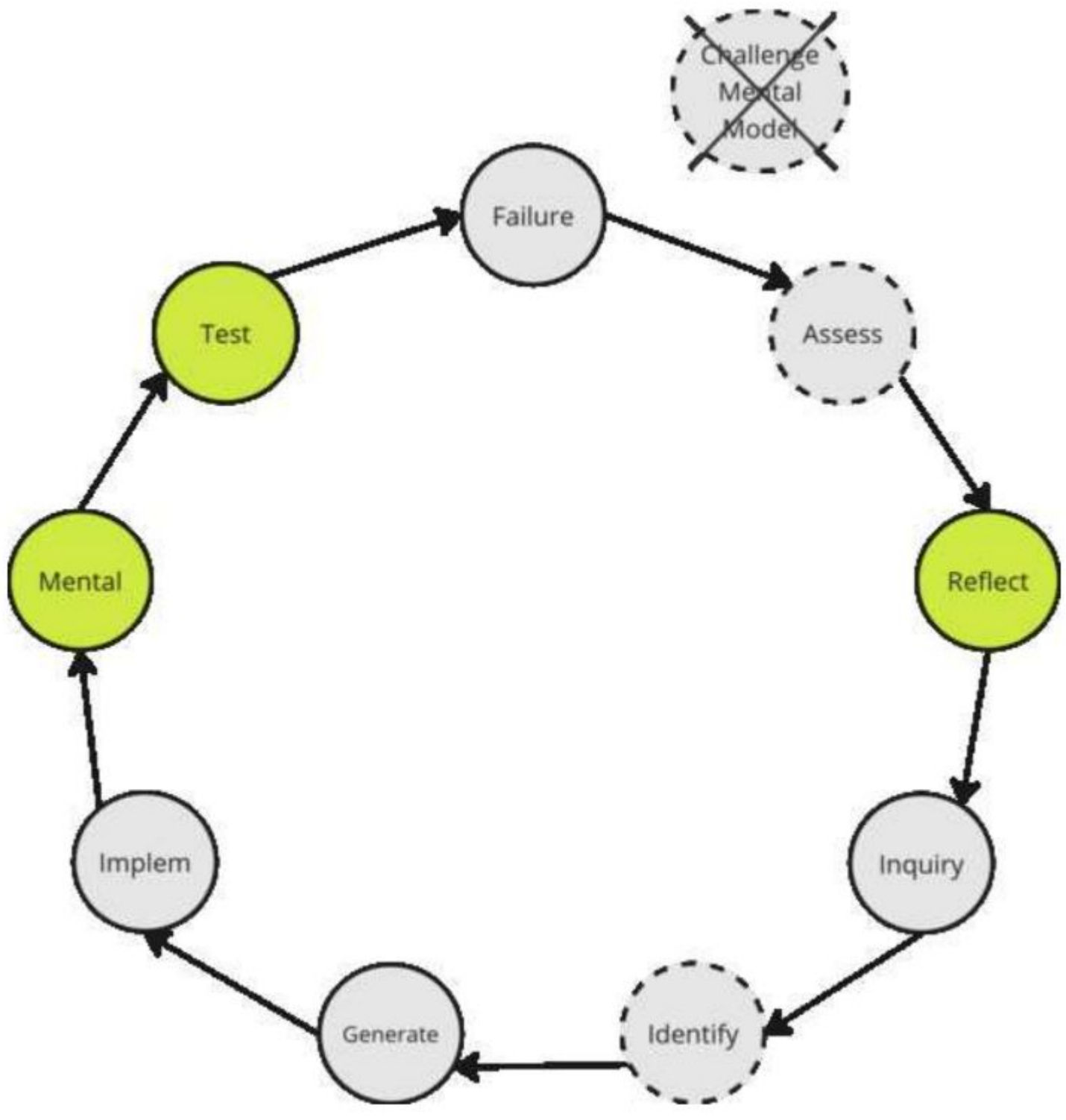


Figure 2. *Failure-based problem-solving cycle codes* (adapted from Tawfik et al., 2015)
Notes. Gray color identifies codes from Tawfik's original model. Dashed outline identifies codes that we modified (e.g., moved or combined). Green color identifies codes we added. Codes for instructional moves are not included.

References

