Examining how object-exploration and explanation-generation influence innovative problem-solving in 5-7-year-olds

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Can we enhance innovation skills in children through prompting them to (2) explore task materials or (2) explain their observations during problem-solving activities?

1. Brief Rationale:

Children struggle with innovative problem-solving until ~8-years [1-2]. Innovation rates improve when functional properties of task materials (e.g., malleability) are highlighted [3]. Exploratory play can help children discover object properties independent from direct adult-instruction [4]. Whether prompting children to explain their discoveries supports innovative problem-solving has not yet been explored [5].

2. Sample:

85 children aged 5-7-years were randomly allocated to one of 5 conditions and completed 2 tasks requiring them to retrieve a token from a vertical tube (within 5-minutes).

3. Conditions:

- **Baseline**: 1-min filler task before task commencement
- **Explore**: 1-min to explore materials before task commencement
- **Explain**: 1-min to explain ideas of how to retrieve the token

4. Tasks:

- **Hook-Tool Task**: Objective: retrieve token
  - Functional material: pipe cleaner
  - Non-functional: string
  - Solution: bend the pipe cleaner to fashion a hook and fish out token

- **Water Displacement Task**: Objective: retrieve token
  - Functional material: marbles
  - Non-functional: cork balls
  - Solution: insert heavy balls to raise the water level, bringing the token into reach.

5. Key Variables:

- Task Success (yes/no): whether or not token is retrieved
- First insertion (functional/non-functional): whether the participant first inserts a functional or non-functional item into the tube.
- Latency to success (in seconds): duration between the start of the task and retrieval of token

6. Results:

- **TASK SUCCESS**:
  - 40 (48.2%) of children succeeded in the hook-tool task.
  - 49 (59%) of children succeeded in the water displacement (WD) task.
  - Analyses conducted on data collected so far (N=85) revealed condition did not significantly predict task success.

- **FIRST INSERTION**:
  - A significant preference for using the functional item for first insertion was observed in the Explore condition in the hook-tool task.
  - No differences emerged as significant for the water displacement task.

- **LATENCY TO SUCCESS**:
  - For those who retrieved the token, time to reach success was not significantly predicted by condition in either task. However, substantial individual variability in performance was observed.
  - Hook: 64.25 (84.23); WD Task: 78.96 (92.46)

6. Exploratory Analyses:

Using detailed behavioral observation methods adopted from animal literature, a fine-grained analysis is underway to help identify which behaviors lead to subsequent task success.

Pre-registered variables of interest include:

- Type of manipulation (e.g., descriptive vs causal)
- Age-related trends in behavior
- Behaviour in Exploratory pre-task phase

1. Discussion Points:

Success rates were similar across ages and conditions. Guiding children to explore materials or explain their actions did not improve problem-solving performance.

A preference for selecting functional items for initial insertion was shown when children explored materials before hand during the Hook-Tool task.

In terms of time to success, there were only slight differences between conditions, but overall performance showed wide individual variability.

9. References: