

STUDYING EINSTELLUNG EFFECT THROUGH STUDENTS' GAZE BEHAVIOR

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The Einstellung effect refers to an individual's tendency to solve a set of problems using a certain complex method repeatedly despite the existence of more direct or simpler methods. In mathematics education, this can manifest in students' routine application of similar solving methods in new or different problem situations. Overcoming such is important for developing mathematical thinking. While the effect is well understood in the psychology of problem-solving (see Abramovich, 2018), we believe that eye-tracking research holds promise in determining the cognitive mechanisms that underpin the persistence of the effect.

Using a post-test two group research design, 17 senior high school students (ages 17-19) were asked to solve 10 algebraic problems adapted from Luchins' (1942) water jar problems. From the results, 13 students were identified to be affected by the Einstellung effect, while the remaining 4 were not. While the students solved, eye-movement indicators, such as "number of fixations" and "fixation duration" on stimuli and non-stimuli parts of the problem were captured using an eye-tracking device. These were compared between the two groups. Cross-analysis of interview and eye-tracking data based on students' solution method and order of viewing of the stimuli in the problems were also carried out.

Preliminary analysis based on 2,000 bootstrap samples using simple method showed a very strong positive correlation between the number of fixations and fixation durations among all participants, $r(168) = 0.97, p < 0.01$. Fixation durations on the white space of affected and not-affected group did not greatly differ, 95% CI [3.68, 5.11], [4.84, 7.78], but it was found that participants not affected by Einstellung demonstrated more fixations on the white space of the screen than those affected, 95% CI [0.56, 11.18]. This latter result suggests that deliberative thinking, as indicated by the students' fixation on non-stimuli areas, might aid in overcoming the Einstellung effect.

References

- Luchins, A. (1942). Mechanization in problem solving: The effect of Einstellung. *Psychological Monographs*, 54(6), i-95. <https://doi.org/10.1037/h0093502>
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